WA-Trans Document Catalog

The documents in this catalog are historical and pertinent to the WA-Trans project. Many other historical documents are included in the Steering Committee Meeting Notes and are not accessible as stand alone documents.
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Executive Summary for the Washington Statewide Transportation Framework for GIS Project

WA-Trans Executive Summary

Purpose

The Washington Statewide Transportation Framework Project (WA-Trans) was organized to create an electronic data "map" of transportation information for use in Geographic Information Systems (GIS) applications across the state. This transportation data (called the transportation layer) will work with other statewide layers being developed or in existence including hydrography (water ways), cadastral (property boundaries), and orthophotography (aerial images rectified for elevation and other factors).

Background

Several cities, counties, transit systems, metropolitan planning organizations (MPO), state and federal agencies have transportation data for use in various GIS applications. Much of this data is collected and maintained individually at great cost, frequently in duplicative efforts, due to lack of communication and partnership. Many applications utilizing cross-jurisdictional data can't be developed or shared without a tremendous amount of rework to the data. Organizations who have application needs but no money to invest in their own GIS systems and their own data collection efforts are at a significant disadvantage and generally can't participate in data exchanges at all.

Objectives

1. Identify and recruit partners to develop, maintain and distribute the transportation framework and framework data that meets a set of business and analytical needs defined by the partners and users.
2. Develop a transportation framework data model and standards based on business and analytical needs for the data, technology available to implement the model, and the ability to provide and maintain the data over time.
3. Define and implement institutional arrangements to facilitate data collection and maintenance partnerships, and to make the data accessible at the least cost with the least restrictions on use.
4. Implement interactive platform independent software, database, and processes to support integration of data received from data providers, maintenance of data by data stewards, and data accessibility by partners and the general public.

Impacts

This project has the ability to assist meeting the business needs of a variety of organizations and business functions that do use, or could use, transportation data with geographic locations. These business functions and some uses can be summarized as follows:

1. Emergency Management
    i. E-911 needs maps to assist with dispatch of emergency vehicles and geographic locations when calls come in from cell-phones or vehicle location systems.
    ii. Emergency or disaster planning for evacuation routes and key transportation infrastructure and to develop models for decision support and analysis.
    iii. Homeland security could use transportation data for analyzing risks and contingency planning.

2. Infrastructure Management
    i. Planning for future transportation needs and uses can be done using statewide transportation data. Currently it is very expensive to combine disparate data from multiple sources over and over again. Alternative analysis can be developed and visualization done with WA-Trans data and related applications. Data about collisions across jurisdictions used for planning and deficiency analysis can be shared and communicated more readily.

   ii. Design or construction can use this data for notification of projects being developed by other jurisdictions or private development, to perform root cause analysis of deficiencies with all related roadways, bridges rails, ferries, and freight data available or simply to communicate project related information to stakeholders and constituents more easily. Multi-jurisdictional projects will really benefit from this data.
   iii. Maintenance and operations can use this data for routing emergency response vehicles and routing traffic around a crash or spill. Other vehicles can be dispatched and routed. ITS applications can be enhanced particularly those that illustrate traffic congestion and problems over the Internet. Currently those applications are only for state highways but the traveling public doesn't care about jurisdiction, just about routes. Tracking assets along a roadway is facilitated with this kind of data.
3. Environmental Analysis and Management
   i. Analysis of watersheds for impervious surfaces would be facilitated with roads, trails and rails in a watershed,
   ii. Evaluating other infrastructure in place for water including tracking storm water systems along roadways could be accommodated.
   iii. Salmon enhancement planning involving ecosystem assessments of road and hydro relations would be facilitated.

This summary of possibilities, depending on which applications are developed by the organizations, using the WA-Trans data is in no way a complete assessment of business needs. However, it does serve to illustrate the diversity of functions and applications that could be served by the successful completion, continual improvement and maintenance of a statewide transportation framework. It is also this diversity of functions that make the construction of the framework difficult.

Project Organization and Approach

The Washington State Geographic Information Council (WAGIC) and the State Framework Management Group support the project. Washington State Department of Transportation (WSDOT) has hired a full-time project manager. This project is being developed using partnerships for funding, resources, data acquisition and maintenance. Partners in the effort include various counties, MPOs, State and Federal Agencies, Tribal Nations and private industry. A multi-jurisdictional steering committee has been actively making project decisions and providing oversight.

Business needs have been gathered and business requirements have been prioritized so the most critical uses can be facilitated first. The project is a phased iterative effort including pilot projects to mitigate risk and determine the effectiveness of various approaches. Current pilot efforts are being funded through a Microsoft Grant, a Cooperative Agreement Program Grant with the U.S. Geological Survey and through a Transportation Pooled Research Consortium involving multiple state departments of transportation and others. These pilots develop integrated data to be evaluated and used and software supporting implementation and maintenance of the transportation framework.

The functionality and accuracy of WA-Trans will depend on the accuracy of the data and funding available for development. As time goes on it is anticipated that accuracy will be improved and gaps in data filled. The goal is to have one "copy" of this data so costs are minimized and accuracy is maintained and improved. A key element is a separate database to allow for transactional updating of the framework to maintain data quality. This piece will be completed after the road-network is done and will be piloted first.

Washington State Transportation Framework

For GIS

Project Charter

Version 2.3

April 2, 2003

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Washington State Transportation Framework for GIS
Project Charter

INTRODUCTION

The purpose of this project charter is to describe the project to develop the GIS Transportation Framework for the State of Washington (WA-TRANS). The charter defines the understandings between the project partners under which the project is to be managed. It also defines project methodology and processes.

The WA-TRANS project is in a state of flux. For some time this project has been handled on a part-time basis by people who are unable to spend enough time on it to allow for predictable progress.

Recently a full time project manager has been assigned to the project. The perspective provided by a project manager includes the disciplines involved in project management such as risk assessment and management; business requirements elicitation, documentation and management; change management; work process schedule and budget management; communications management; and issue management. It is expected that a different perspective will be brought to the project regarding determination of scope, business needs and business requirements, deliverables, project methodology and approach and other project management rigors.

Because of the changes described above it would be of benefit to revisit the project charter and the plan for the Transportation Framework described in that charter. This charter will reflect those changes. The charter also includes some action items, which will focus effort on areas, which have not yet been completed in the original charter plan or to which more attention needs to be paid.

VISION

The Washington State Transportation Framework is a seamless set of data that are consistent, connected, and continuous between segments of the transportation framework and with other framework layers. The transportation framework represents the best data available and includes mechanisms to improve over time. Framework data is accessible to the general public at the least cost with the least restrictions**.**

BACKGROUND

The Washington Geographic Information Council (WAGIC) strategic plan calls for development of a geospatial framework to facilitate sharing of data and to enable cross-jurisdictional analysis. Identified data themes include cadastral (property ownership), hydrography (surface waters), transportation, ortho-imagery (corrected aerial photographs), and topography (elevation) data sets. Completing the development of the transportation data theme is the goal of this project.

The WA-TRANS project has been ongoing for some time. Considering the part-time, volunteer nature of the project previously, a fair amount of work has been completed. The original charter outlines work done prior to October 1999. Committees that have been in place have been retooled for the purposes of "supporting " this project as well as other GIS and framework related projects. These include the Inter-organizational Resource Information Coordinating Council (IRICC) Roads Committee, the Washington Transportation Framework Group, the Washington Framework Management Group (FMG), and the Washington Geographic Information Council (WAGIC).

A series of individual workshops were organized regarding different approaches and implementation strategies for the framework. More recent work includes the Oregon Department of Transportation County GIS Mapping Pilot Project conducted with Wasco County data and the ongoing effort with Portland State University's Kenneth Dueker, Ph.D. and Paul Bender, to develop the White Paper on Issues and Strategies for Building a State Transportation Framework. This white paper outlines some business drivers and requirements for a Washington Transportation Framework, design options, strategies and issues. It outlines some possible pilot studies to use for assisting decision making for the framework project. Finally, other states' efforts will also be reviewed and considered. All this work needs to be examined for lessons learned and used as a basis for strategies for the future.

One additional item of interest which should be documented in relationship to this project happened as a result of the events in New York, NY and Washington D.C. on September 11, 2001. President George W. Bush's Administration has announced that the geospatial initiative is a presidential priority. Key driving forces behind this announcement is recognition of the role of framework in Administration focus areas - Homeland Security and preparedness, and e-government. As a result, there is an increased emphasis on completion of the framework including very aggressive time lines in the federal government. As examples, federal core data standards are to be completed within the next few months and spatial data is to be collected for 120 cities. This provides greater impetus for developing a robust transportation framework. It also means that there may be some legal changes and funding opportunities that affect the project and the partners' participation.

APPROACH

The approach for this project is based upon project management processes and the unique issues of developing a framework project. The following is a high level view of this approach:

- The approach to the project includes gathering and/or verifying detailed business needs to use as the basis for all project decisions. These business needs provide the basis for business requirements that can be prioritized based on urgency, funding and technical issues, which impact the order work, can be done.

- Pilots will be identified to meet two needs. One type of pilot is to test a technical issue and the results of these types of pilots may be more prototypes or proof-of-concepts than actual useful framework deliverables. Another type of pilot will be set up to test with a small set of partners and data the overall concepts of how to build and maintain a framework including interagency relationships and agreements. These types of pilots provide mitigation of the risk involved with trying to build the whole framework and not knowing the best process for doing so. It is expected that the results of these pilots and the processes involved in them will be part of the final framework, if successful.
- Based upon the experience from pilot projects an approach and process will be defined for doing the full framework and the first release of the framework will be developed. This includes all deliverables needed to begin maintenance of this version of the framework.
- Additional versions of the framework with additional capabilities based upon business requirement prioritization will be developed.

This plan assumes that development of the transportation framework will be a phased iterative process that will result in change to this charter and to requirements as we learn. Each phase will have a mini-charter developed which will be specific to that phase with deliverables, roles and responsibilities and work plan and budget defined.

For more detail of the project approach and methodology please see the "Project Management Methodology and Approach" section later in this charter.

NEEDS ASSESSMENT

Needs assessment is the primary focus of Phase I as defined in the methodology. It is critical that business needs be defined as completely as possible so the framework is not unintentionally developed in an exclusionary format. Business needs have been defined previously and these need to be verified. Where there are gaps identified in the business needs (missing partners, missing needs, etc.) business needs will be gathered. Gathering and/or verifying business needs can also provide some less obvious benefits. Those include informing and sharing with non-GIS users the benefit of GIS and sharing data; establishing contact with managers and decision makers for organizations which could lead to funding and resource opportunities; and discovering new business needs which could provide opportunities to use GIS by new groups. A good needs assessment should guide all project decisions including scope, requirements priorities, strategies and data.

The process for gathering or verifying business needs will begin with WSDOT in order to be prepared for the legislative budgeting process for the '03 – '05 biennium. Justifying the use of a WSDOT FTE and set the stage to get more funding and resources from WSDOT requires definition of benefit to the organization and establishing a high level cost benefit.

Additionally the Washington Transportation Framework Group (WTFG) will be leveraged to gather business needs. Where possible the members of that group can document or verify business needs. Additionally they can provide information to the project about potential contacts. As much as possible, a sampling of counties and communities from both east and west will be interviewed. A survey may be used to identify high level needs and opportunities that merit further investigation. This survey would be distributed partly by the WTFG.

OBJECTIVES

The project objectives identify the major things that need to be accomplished to implement the transportation framework. It is anticipated that these objectives will be refined as the project progresses and more is learned about business needs, the capabilities of existing technology, and the condition of existing data. These are summary objectives:

1. *Identify and recruit partners to develop, maintain, and distribute the transportation framework and framework data that meets a set of business and analytical needs defined by the partners and users.*
2. *Develop a transportation framework data model and standards based on business and analytical needs for the data, technology available to implement the model, and the ability to provide and maintain the data over time.*
3. *Define and implement institutional arrangements to facilitate data collection and maintenance partnerships, and to make the data accessible at the least cost with the least restrictions on use.*
4. *Implement interactive platform independent software, database, and processes to support integration of data received from data providers, maintenance of data by data stewards, and data accessibility by partners and the general public.*

SCOPE

Discussion

The scope of the WA-TRANS is not yet well defined. The previous project charter does not completely define a scope which is related to a business perspective because the scope defined in that charter is not linked to any clearly documented business needs or requirements but to data. The business needs are the driver behind a project and should frame the scope. Lacking such documentation the scope in the charter appears to be a technical determination of what can be accomplished. While this is necessary, it should be done after business requirements are completed and mapped back to those requirements.

A high-level project scope can be defined based upon what is thought to be the overriding business need. Once business needs and business requirements are documented, approved, and prioritized by partners then a detailed scope based upon those requirements can be developed. This is very useful in a phased approach because discrete sub-projects can be developed for each phase and/or release based upon which business requirements make up the scope. There is a document to go back to for determining what is in scope and out of scope for change control. There is also the business case to use for justifying funding at each phase or release. Once business requirements have been completed and the scope determined then functional requirements are developed from the scope and system requirements specification are developed. These then become the technical blueprint. This is where questions regarding which algorithms and technical capabilities need to be available to meet the defined business need.

The following is a high-level scope for the project prior to business requirements definition:

Cooperatively develop a statewide transportation framework for GIS including:

- ✓ *Business requirements which align with business needs documented from as many Partners as can be engaged during the process,*
- ✓ *Process for developing the framework,*
- ✓ *Data structures for developing and maintaining the framework aligned to business requirements,*
- ✓ *Security, access and translation tools which facilitate access, use and maintenance of the framework based upon functional requirements identified,*
- ✓ *Memorandums of Agreement regarding use of resources and funding for the framework,*
- ✓ *Memorandums of Understanding and data sharing agreements to facilitate data sharing.*

Action Item → Articulate a high level project scope and then refine based upon business requirements and priorities.

CRITICAL SUCCESS FACTORS

In support of project objectives specific critical success factors were defined. These critical success factors are listed below with notes on the progress so far in establishing them. Bolded italicized elements of a critical success factor are new items that were not in the previous charter. Generalized action items are listed with each critical success factor:

1. *Establish broad participation.*

Identify and recruit partners who . . .

- Can identify a business case for investing in the transportation framework,
- Represent a range of uses of the database,
- Are needed to create full data coverage.

Current Status and Discussion

Partnerships have been developed and work has begun on the WA-TRANS. There are two primary groups identified which have provided input and some level of consensus decision making for the project. Those groups are the IRICC Roads Committee, and the Washington Transportation Framework Group. The Washington Transportation Framework Group has fairly broad-based participation. Participation in these groups has dwindled over time. However a role for the IRICC in the project has been defined in the roles and responsibilities section of this document. Some effort needs to be put into making sure there is adequate representation from cities and others who may be Partners. A list of as many potential partners as possible should be developed.

Another potential area of participation is across state and country boundaries. We need to consider Oregon, Idaho and Canada (British Columbia). As stated previously Oregon is already participating in the IRICC Roads Committee. Contact was established with Idaho at a recent Regional Framework Meeting between Washington, Oregon and Idaho Framework participants.

Action Item → Develop and maintain a list of all potential partners. Try to establish or re-establish contact with them.

Getting enough participation needs to be balanced with making sure there are few enough participants with decision making authority involved so that decisions can be reached expediently. Clear roles and responsibilities need to be evaluated and maybe further defined for this. There can be ways to participate in terms of requirements gathering and verification that does not necessarily include decision-making for the project. Those who make decisions for the project will need to devote more time and effort than those who don't. This may involve using the groups already in place or it may involve defining some other participation structure. See the section titled "Decision Making Process" for a proposed strategy on decision-making.

Action Item → Determine the optimal structure for partner participation and decision making in the project.

A key element to gathering funding is identifying the business case. The reality is there may be many business cases, which can be used to justify funding. At this point in time there are several different business needs identified, but no real "cost benefit analysis" to turn those needs into business cases. Additionally there has been no linking of business need to business processes supported. This also must be done to justify funding and participation. This is a critical need to be handled early on in the project timeline. The complexities may reside in prioritizing conflicting or competing business needs in terms

of resources and time for completing implementation so business results can be gained. The business case may very well influence the scope. The source of funding may also influence the scope, particularly which deliverables and functionality or data are available at a particular product release. Group cost/benefit efforts may be used to determine priorities among business cases and to prepare for funding to be available at the right time.

Action Item → Document the business needs and cost benefit justifications for participation in and funding of the Washington Transportation Framework by partner section or function.

2. Establish standards, which enhance the will and ability of partners to collect and maintain the data.

- Match the standard to the ability of the partners to collect and maintain the data.
- Identify a standard which allows data quality to improve over time.
- Identify funding incentives for partners to participate.

Current Status and Discussion

Although the WA-TRANS project helped to develop the IRICC Core Standards, it was later determined that this approach did not provide standard segmenting methods for centerlines. There was a great deal of disagreement about segments and segment identifiers. It was also focused on a limited business need and was viewed as not broadly based enough to justify the needed participation. The National Spatial Data Infrastructure (NSDI) Transportation Identification Standard was also examined. Because the NSDI requires a schema of link identifications, this would be very difficult to impose on the players. Some have already set up identifiers and it would be difficult to force then into a new ones.

However the biggest concern about standards at this time is that the business requirements are not defined from the original business process point and business needs to help determine which standards make the most sense and which will facilitate meeting those business needs. It is not yet time to decide on standards.

Action Item → Develop a robust set of business requirements with broad-based user participation.

3. Provide the data needed to meet business and analytical needs.

Data must be . . .

- Accurate.
- Complete.
- Not too complicated to use.

- Described and documented.
- Up-to-date.
- Relevant to business and analytical needs.
- Digital.
- Formatted in open standard, relational structure.
- Able to be imported into commercial digital mapping systems.

Current Status and Discussion

One of the big concerns with the previous work on the WA-TRANS is that defining the data for the framework seems to be where all the effort has been focused. The data identified can't necessarily be linked back to business needs. The documentation demonstrating such a link does not exist. It isn't based on problems, which may be solved by a transportation framework, but on some group's idea of what may be needed. Additionally the group had a very difficult time defining and agreeing to what constituted data for the framework. In the absence of clearly documented business needs and business requirements it is unclear which data is mandatory to meet those needs. There is also no mechanism for determining what to implement first. The data design on content must be based upon business requirements.

Action Item → Define what constitutes WA-TRANS data and identify data requirements as part of the business requirements.

4. Define a data model that partners agree meets their needs.

- Identify business needs and functional requirements, and define the data needed to support them.
- Examine existing data models.
- Seek consensus agreement on the data model. Partners commit to achieving consensus.
- Provide frequent and on-going communication of progress and decisions to partner organizations.

Current Status and Discussion

Previously the project examined NCHRP 20-27 (in Report 460), the Enterprise Data Model (Dueker, Butler) and the UNETRANS model by ESRI. The NSDI was also reviewed. The knowledge gained in these examinations need to be considered in any data model decisions.

It would be good to design the logical data model as a whole at one time early in the design process and only implement the pieces of the physical model in phases as needed to simplify the process.

Action Item → Develop a preliminary logical data model for WA-TRANS that supports all business and functional requirements identified regardless of which phase the requirements will be implemented in. (See critical success factor # 7 below.)

5. Identify the right standards and processes.

- Identify standards and processes needed to meet business needs.
- Examine existing standards and processes.
- Identify standards and processes needed to facilitate integration of data from multiple sources.
- ***Identify standards and processes, which facilitate maintaining the data long term.***

Current Status and Discussion
See critical success factor #2 above.

6. Identify standards and processes that recognize the capabilities of existing technology to support the standards and processes.

- Identify standards and processes that recognize the capabilities of existing technology to support the standards.
- Provide tools for data integration, data access, and metadata.

Current Status and Discussion
See critical success factor #2 above.

7. Phased Development

- Set the scope of phases to allow delivery of tangible products within a set time frame.
- ***Use phases as a method of showing an effort and plan to meet all business needs while focusing on the ones, which can most realistically be met at the current time.***

Current Status and Discussion
It would be of benefit to use a phased process by which the WA-TRANS can begin again while utilizing what has already been done. The goal of a phased iterative approach is to break the project down into manageable chunks, with clearly defined objectives, scope, requirements, cost, risk and timeline so it can be handled as a single effort and with a defined budget.

It will use the work already done, particularly in evaluation of standards and research on the approach or data structure. It will also use the business needs already identified. There will be a comprehensive business requirements document. There will be a formal cost benefit done. Both will assist with getting partners involved and justifying funding. Both will also provide a basis for decisions on the scope of each phase and pilot implemented. Both will also provide a basis for determining what data or tools were available with different releases and resolving issues regarding data ownership and data stewardship. So there is an initial phase proposed to be dedicated to these items. For

more detail on defined phases and scopes please see the Project Management Methodology and Approach section of this document.
Action Item → Evaluate existing development strategy and redesign as needed.

KEY DELIVERABLES

Deliverables are divided into two categories. These are Project Deliverables and Project Management Deliverables. The project deliverables are the actual items for the project, which must be completed to deliver the project. These items become major components of the final deliverable. By contrast the project management deliverables are the items that are tools used to manage the project. They provide the documentation and methods for making sure the project scope, schedule, budget and risk are adequately tracked and managed. They are based upon the Project Management Body of Knowledge (PMBOK) produced by the Project Management Institute (PMI). PMI is accepted as an authority on project management practices and procedures for projects in all disciplines.

Project Deliverables

Four additional deliverables have been added to the original charters deliverable list. They should be done first and are listed first. Following those are the project deliverables defined in the January 2000 Charter followed by some strategies and ideas for implementing them:

1. Business Needs:
   Business needs gathering involves identifying the business processes that could be improved by the WA-TRANS. These needs include much more than what the framework will actually do. However, without the framework meeting these needs are impossible or much more expensive. These needs make the basis for justifying the funding and resources for the framework. Business needs describe WHY the transportation framework is developed and WHY it must meet particular business requirements. The previous transportation framework effort did document some business needs at a high level. These need to be verified and possibly enhanced with more detail. A gap analysis needs to be done between what has been identified and what still needs to be identified. If there are any previously unidentified partner business types or business needs must be gathered for those.

2. Business Requirements:
   Business requirements are formally defined business expectations of the system, stated as imperatives. They are derived from the identified business needs. Business requirements define WHAT the transportation framework must do. These requirements will be formally inspected and accepted by the participants as true and complete at the time of inspection. A change control process is used to change requirements once they have been accepted. The requirements should be prioritized

by the partners and then decisions will be made about them regarding what requirements will be in what releases of the product. Costs estimates and schedule estimates can be done of each requirement. Additionally, these requirements can be used to prioritize and further define pilot projects. Because of the large potential project partner community and the variety of business requirements to be captured gathering these requirements could take several months or longer.

3. Cost Benefit Analysis:
   To justify funding and participation it would be helpful if each partner on the business requirements that are agreed upon did a cost benefit analysis, particularly for the requirements they bring to the table. This would also help in the prioritization process.

4. Functional Requirements:
   Functional requirements should be developed from the business requirements and should map back directly to an individual business requirement (although they may meet more than one). Functional requirements are used to describe the actual functionality the transportation framework must have to meet the business requirements. If the business requirements describe WHAT the WA-TRANS must do the functional requirements describe HOW the WA-TRANS must do it.

5. Data Model
   This process includes developing a high level conceptual model (logical data model). This model may be developed based upon existing accepted models such as those previously examined by the project. It would be good to develop a model which included as many business needs as possible and then only implement those portions needed for each phase as appropriate. The design may or may not be based upon a distributed model.

6. Database
   Implement only the portion needed for each phase or release or pilot.

7. Data access and distribution software and process
   This could be a clearing-house or web application or some other method to be determined based upon business requirements and technical limitation and capabilities. Other framework theme implementation in the state and other state solutions should be examined.

8. Data integration standards, processes and tools
   These are based upon the approach and standards both developed externally and selected for use and those developed by the project. Tools developed are based upon business requirements by phase or release.

9. Partnership agreements
   Partnerships are based upon who is participating at what point in time. These will be an ongoing effort and should be included in maintenance plans. Developing a

template agreement might be of value down the road for facilitating this process under a maintenance situation. A process for updating and maintaining partnership agreements should also be developed.

10. Definition of roles
    There will be a variety of different roles including data provider/owner/stewards, data maintainer, tool maintainer, etc. The Dueker and Bender document does a good job of outlining some of these potential roles. These need to be defined for each product developed in each mini-charter and as a part of partnership agreements and maintenance plans.

11. Pilot project*s* to populate the database – limited geographic area and limited data content
    It needs to be recognized that there will be more than one pilot and so a list of potential pilots must be made and priorities assigned to that list. The goals of those pilots may not be to populate the database The Dueker and Bender white paper identified some pilots to consider.

12. Plan for maintaining the transportation framework
    This is a critical factor and must be developed and updated in phases based upon each release. Anything developed that is to be used for production should be covered under maintenance. This needs to include funding plans and maintenance of partnerships.

13. Project reports.
    These reports should include lessons learned and recommendations for future direction and follow-on phases. Each phase should have a report.

None of these deliverables have been completed at the time this document has been written. One thing that might help flesh out what these deliverables could be is looking at lessons learned from other framework projects, both in Washington and other states.

Items 6 through 13 could be repeated iteratively for many phases as needed. These deliverables are actually incorporated in with the project management deliverables in a recommended high level project plan in the section titled “Project Management Methodology and Approach” that follows.

Project Management Deliverables

The January 2000 Charter did not identify project management deliverables. These deliverables are added to adhere to a formalized project management approach. Project management deliverables are as described below:

- Develop Decision Package and Formal Funding
  Initially this will require focusing on the WSDOT business case for the Transportation Framework. It will require those needs be documented and a cost-benefit analysis be performed. Later funding may be gathered from other sources based upon business cases for other organizational participation and agreements with those organizations.

- Establish Formal Project Reporting and Decision Making Structure
  The WA-TRANS project has the potential of having a great many potential decision-makers that can make reaching decisions very difficult. One way of dealing with this is identifying a formal decision making team with the authority to act for the larger group of partners. The decision makers (called the Steering Committee) approve project scope and charter and decide priorities of business requirements and assist with change control decisions and issue escalation and resolution. This group also decides the approach to the project and the framework. The rest of the partners participate providing business requirements, final acceptance of business requirements that originate or strongly affect them, testing the various components of the framework and providing resources for pilots or other situations. They are kept informed of decisions and deliverables made by the Steering Committee. It may be that for various phases the membership of the Steering Committee could change as needed when a particular group is funding something specific or has a very high priority need which is being implemented. To facilitate decisions there must be a smaller structure that has the authority to make decisions expediently so the project progresses. The steering committee will be formed to serve this function.

- Project Charter
  This document is the Project Charter. It will eventually have the deliverables defined below as appendices.

- Risk Assessment and Management Plan
  Because of the size and number of organizations potentially impacted, and project complexity the Washington Transportation Framework project could be considered high risk. A formal risk assessment needs to be developed for the project. It needs to be updated as business requirements are formally developed and then it should be updated for each pilot and each phase. It will include risk mitigation strategies and triggers to facilitate recognition of the development of a risk situation and provide strategies for handling the situation.

- Communication Plan
  Communication is a critical factor in any project and because of the different business needs, political environments and governing bodies of the partners in this project it is more critical than ever. A well thought out communication plan would be of great benefit to the project along with strategies for "selling" the idea of the framework to partners whose data may be needed. This plan needs to include status reporting mechanisms and outreach methods. The plan will define how the Steering Committee is kept involved and how the other partners are kept informed of their activities.

- Change Control Plan
  Change control is the process of keeping the project in scope based upon accepted business requirements. It is also the process for changing the scope when the project decision makers deem it appropriate. It facilitates a formal and documented process to manage the scope of a project. Each phase will have its own scope, budget and resources and this is the level at which change management is the most critical

- Issue Management and Dispute Resolution Plan
  Issues should be documented as well as the resolution so there is a record when the problem arises again. It is also useful for the lessons learned process. Issues require a formal escalation procedure for resolution. This is especially true when a business issue arises. Business issues usually must be resolved at a management level, which may not be directly involved in the project on a day-to-day basis. Disputes are a form of issues. The plans for issue management and escalation need to be formally defined. See the section titled "Decision Making Process" for some plans regarding issue escalation.

- Project Plans
  High-level project plans should be defined in the charter. Detailed plans should be done in a scheduling tool. These plans needs to be detailed enough that "what-if" scenarios can be developed with them. They also need to be developed at a high level for what is known and then the detail added as enough scope or business requirements are provided that they can be expanded in detail. They also need to show the required resources and project budget and should be kept up to date on a regular basis.

- Project Mini-charters
  There may be some fear that too much time will be spent developing charters. But these little charters don't need to be longer than a couple of pages depending on the size of the effort. Each of the pilots should have a mini-charter and they should be developed for each phase. Each should include: purpose or objective of phase or activity, scope, how this portion of the project fits into the whole, deliverables, roles and responsibilities, time-line (project plan), budget, and assumptions. They can "inherit" the change management, issue management,

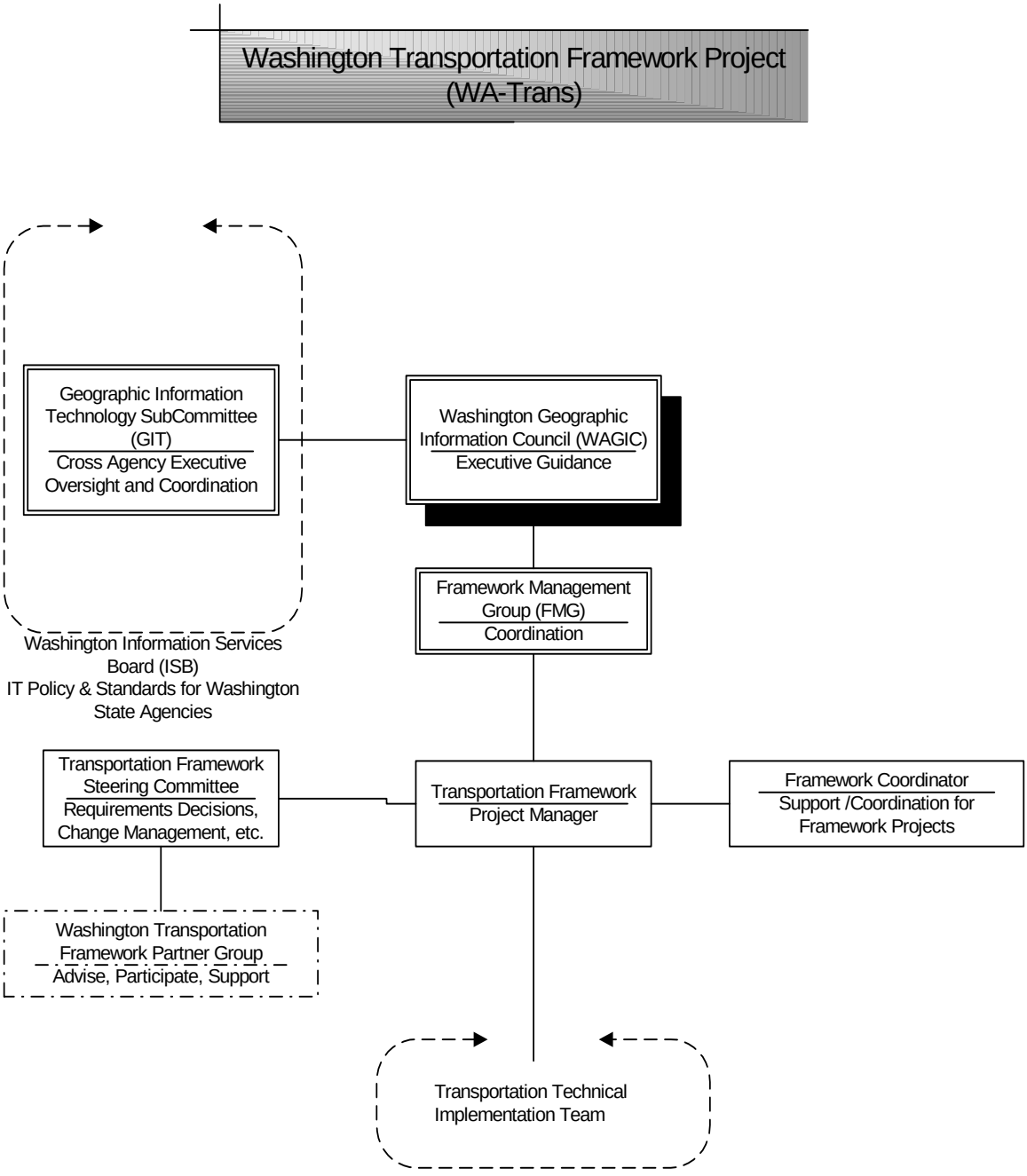
and communication plan for the overall project. The risk assessment should be updated based upon each project phase or effort.

ASSUMPTIONS

1. Sufficient partners representing data providers and data users participate in the project. The exact number is uncertain, but there should be a representative participation from the various groups who will be primary data providers and/or primary business users of the product.
2. Funding and resources are available from partner organizations for a project manager, data modeling, software development and maintenance.
3. Key staff resources with the necessary technical ability are available and can be scheduled to complete project tasks. While it is not yet possible to completely define the technical ability required it is assumed that when this is defined the ability will exist to provide or acquire these resources.
4. Agreement can be reached on a common data model.
5. Agreement can be reached on a common linear referencing system if one is needed.
6. Technical capabilities of the software, hardware, and resources are available to support business needs.
7. A phased approach will be utilized to develop the framework incrementally.
8. Existing infrastructure will be used to make transportation framework data accessible.
9. The transportation framework project and other framework projects will be coordinated.
10. The first implementation of the framework will be simple and a plan will exist for increasing complexity and functionality over time.
11. Sufficient business value will be discovered and documented to compel participation in building, using and maintaining the WA-TRANS.
12. Pilot test results will represent the statewide situation enough to use these results to determine approaches.
13. When pilots are successful the results will become part of the framework implementation.
14. Negotiation, compromise and facilitation will be utilized to arrive at implementation priorities. Funding source may be considered a key issue in deciding such priorities.
15. A steering committee will be organized for the project that will have the authority in their individual organizations to access resources and possibly funds to assist with the various phases of the project. The size of this steering committee will be dependant upon what is required to get adequate representation for different business areas. However at this time it is hoped that steering committee will be limited to 13 members including the project manager.
16. Membership of the steering committee may change as phase deliverables change.

17. The steering committee will be able to participate to the level of providing detailed analysis and decision-making about business requirements, functional requirements and prioritization of requirements. The steering committee will also be available at least once a month for meetings in order to facilitate change management and issue management.
18. The steering committee will be representative of the Washington Transportation Framework Partner Group.
19. The steering committee will be small enough to facilitate effective decision-making.
20. Any project plans for implementation will include plans and funding sources for maintenance of what is implemented.
21. WAGIC and FMG will assist with pursuing funding.

PROJECT ORGANIZATION



ROLES AND RESPONSIBILITIES

Washington Information Services Board (IBS)

The ISB sets IT policy and standards for Washington State Agencies. It is made up of various Governor appointees and judicial and legislative appointees.

Geographic Information Technology Subcommittee (GIT)

This committee makes recommendations to the ISB. It includes Washington State Agency executives and other representatives including 2 members of the ISB. This committee provides executive support and input to WAGIC activities and a coordinated approach to GIS for state agencies.

Washington State Geographic Information Council (WAGIC)

The WAGIC is recognized as the statewide body responsible for coordinating and facilitating the use and development of Washington State's geospatial information. WAGIC is an advisory body to the Framework Management Group (FMG) and supports the vision of the Washington Geospatial Data Framework. WAGIC serves as a resource for dispute resolution and/or deadlock decision making to the FMG.

Framework Management Group (FMG)

The FMG is a consensus building body that provides overall direction to individual framework projects. The FMG determines framework priorities, identifies and facilitates resolution of common framework issues, and ensures coordination among the projects. Overall framework decisions and decisions that are out of individual project scope are made by the FMG. Widespread participation is solicited and encouraged from federal, state, local, private, tribal, and professional organizations.

Framework Coordinator

The Framework Coordinator provides coordination between framework projects and support of individual projects.

Washington Transportation Framework Partners

The Transportation Framework Project Team is made up of representatives from the partner organizations. The project team is responsible for the approval of the project charter, high-level project approach, final project business and functional requirements, and high-level project deliverables. Decisions will be discussed at quarterly meetings and then voted on regarding the ability of the partner to live with the decision or not. Dissenting votes will be discussed and then another vote taken. The second vote counts.

Transportation Framework Project Steering Committee

This committee is made up of representative from the project partners group. These representatives are willing to commit more time to the project and may have the ability to assist with providing resources or funding to the project. They may have a particular expertise regarding a priority business need, which is to be implemented for a particular phase. This group assists with development and evaluation of the business requirements and prioritizes them, develops functional requirements for a particular set of deliverables, determines the scope of individual phases of the project, supports that scope with change management, and provides issue resolution support. They will meet at least every six weeks for the duration of the project and the membership may change as needed. They may be called on for more time to make major decisions particularly during the business requirements and functional requirements development and evaluation phase.

IRICC Roads Committee

The Interorganizational Resource Information Coordinating Council (IRICC) has expressed a commitment to participate in this project through the Roads Committee. The IRICC represents the needs of some Federal organizations including US Forest Service, The Bureau of Land Management, and Fish, Wildlife and Parks. All groups have some concern and business needs associated with the transportation framework. Additionally the Roads Committee includes representatives from the State of Oregon who are working on a transportation framework for their state. We will need to discuss how those frameworks can "connect". The USGS also participates in the IRICC. The IRICC Roads Committee has come up with a standard for transportation data that represents those needs. This standard needs to be examined carefully by the transportation framework project and seriously considered for inclusion in the standard selected in order to facilitate inclusion of these organizations in the Washington Transportation Framework. Their business needs are similar to other environmental organizations involved in the project.

Thus the IRICC provides an opportunity to bring these players to the table and to perform some specific pilots, which may provide useful input to the project. Additionally the role of IRICC will be to provide coordination between Washington and Oregon transportation framework projects. The IRICC has also been a key player in the Washington Hydrography Framework. Thus they can assist with making sure the two frameworks "align".

Transportation Framework Project Manager

The Transportation Framework Project Manager is responsible to lead development of the transportation framework. This includes leadership of the project team, reporting of progress and milestones to the Framework Management Group, cross-project coordination with other framework projects, successfully recruiting project partners, arranging resources for the project, project planning and schedule tracking, and project budget and expenditure tracking. This person provides project management expertise to the project and develops and maintains the project management deliverables defined in this document.

Transportation Framework Strike Teams

The framework strike teams will be formed with the goal of being a timely focused structure to more deeply research, test, and resolve issues to allow better decisions to be made. The team would be chartered for an appropriate duration for the task. The resources for this could be provided by a variety of sources including the Transportation Framework Technical Team or technical experts that reside within partner organizations.

Transportation Framework Technical Team

The technical team functions as the working group for the project. The technical team consists of experts in data production, data use, data access methods, etc. The technical team provides decision options and recommendations to the project team. Final decisions are made by the project manager for day-to-day process or the project steering team for change control and other major issues. The project manager may appoint a technical team leader for that group who will have some day-to-day leadership responsibilities as well.

Administrative Support

The Administrative Support person is responsible for: scheduling of project meetings; booking, setting up and taking down meeting rooms; communication with participants; preparing and distributing project documentation; taking and distributing meeting notes; maintaining contact lists; and, working closely with the Project Manager to support the success of the project.

PROJECT RESOURCES

The project manager is a Washington Department of Transportation Employee. To the degree that project resources are available and can be justified by the business needs that the transportation framework is providing the Agency other WSDOT resources may also participate.

It is the project manager's responsibility to determine resource needs and skill levels required for each phase of the project as part of the project plan. These needs are provided to the project steering committee and if needed to the project partner group. An effort will be made to gather resources from them. If needed funding will be used to purchase contract resources to fill gaps.

Resources will report to the project manager or a project technical lead if one is available. All deliverables will be based upon a project schedule which will be provided to project resources and their management. The managers will commit the resource based upon that schedule. When schedule changes occur which affect the amount of time or scheduling of resource participation the project manager must report that as soon as possible to both the project resources and their manager. Adjustments must be negotiated as needed with formal agreement made for significant changes. The resources and their managers must provide the project manager with advance notice when a resource will be

unable to provide the level of participation promised for a project. Again these changes will be negotiated with impact to the project schedule and budget determined prior to negotiation. All resources provided for the project will be documented and agreements made formally to facilitate mutual expectations and support project progress regarding those resources.

The project manager is responsible to provide status reports to the project steering committee at monthly meeting and the project partners at quarterly meetings regarding the use of project resources and the schedule of deliverables dependant upon those resources.

It must be made clear that without resources the project cannot succeed. At the end of the State Biennium (June 2003) an evaluation must be done regarding the level of resource commitments made and adhered to for the WA-TRANS project. At that time if there has been a continuous significant lack of resources provided to make reasonable progress against work plans a decision may be entertained to redirect the resources that WSDOT is providing the project.

FUNDING

Funding will likely be provided by a variety of sources. Funding may affect decisions of project requirement priorities. The membership of the project steering team should include representation from any sources of funding for the project. Agreements regarding the use of funding for project deliverables and resources will be formally documented with the funding organization, the project manager and the project steering committee to facilitate mutual expectations and support project progress regarding that funding.

The project manager is responsible for the budget and will provide budget status reports at each steering committee meeting as well as quarterly partner meetings.

It must be understood that without funding the project cannot succeed. All reasonable effort will be made by the project team, WAGIC and FMG to pursue funding opportunities. However, if at the end of the State Biennium (June 2003) there has been a continuous significant lack of available funding, thus leading to minimal completion of project deliverables against work plans a decision may be entertained to redirect the resources the WSDOT is providing the project.

DECISION MAKING PROCESS

Project decisions will be made at the lowest possible level and at the earliest possible time. For day-to-day activities the project manager will make project decisions or the technical team lead. Decisions which impact the deliverable functionality, project scope, or significant budget, resource or schedule change the decision will be escalated to the project steering committee. When possible the decision will be made at monthly steering committee meetings. When time does not allow for waiting for the committee to meet e-mail, phone calls, and conference calls will be used to facilitate making a timely decision. The transportation framework partners will approve major project deliverables.

When the decision involves coordinating with another framework effort or standards that impact other framework efforts the issue will be escalated to the Framework Management Group. When the decision involves GIS policy or executive level support it will be escalated to the Washington State Geographic Information Council.

PILOT PROJECTS

There are two types of pilots that could be used to support decision making for the transportation framework project. Each is discussed in the following:

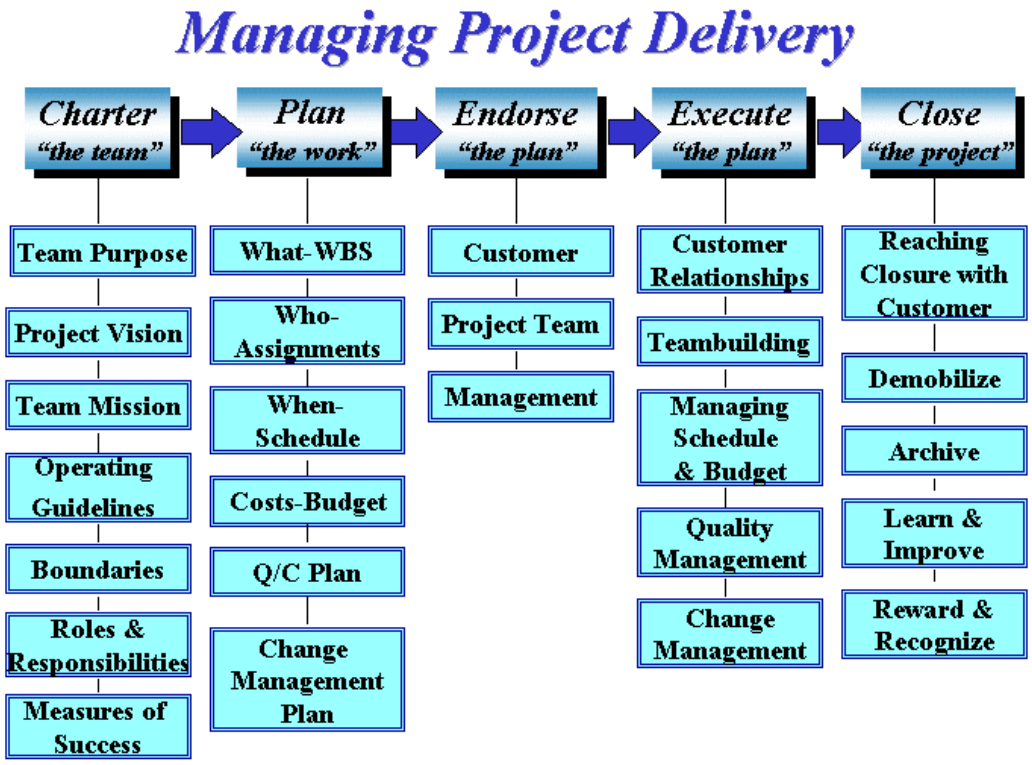
Proof of Concept: The proof of concept is an effort that will help decide technical concerns regarding the project. This kind of pilot is likely to be thrown away and is on a small enough scale that it does not need to be set up as a mini project. It is a risk management technique that will be utilized whenever there is inadequate information or experience on a particular type of technical solution.

Pilot Mini-Project: The pilot mini-project will be set up with a mini-charter, which defines roles and responsibilities, deliverables, schedule, budget and resources. This technique will be used to determine the approach for the project to follow regarding completion of various deliverables. These pilot mini-projects will be conducted on a small scale to reduce project risk. The results of a pilot mini-project that produce a deliverable of the quality needed for the particular implementation of the transportation framework will be integrated into that implementation

PROJECT MANAGEMENT METHODOLOGY AND APPROACH

Project Methodology

The WA-TRANS project will use the Managing Project Delivery (MPD) methodology integrated in with a system development lifecycle (SDLC) process. The MDP methodology is the WSDOT method for managing projects Agency-wide. This method has been selected for a variety of reasons. The first is that in effort to garner funding from the Washington State Legislature the project becomes a candidate for Department of Information Services (DIS) oversight. These projects must be managed with a formalized project management methodology. WSDOT put a great deal of effort into developing the MPD process. It is based upon the PMBOK and it is Agency policy that all capitol projects will be managed using this methodology. The WSDOT customers whose business needs will form the basis for justifying the funding will understand the method. The MPD method is outlined in the following graphic:



Project Approach

IT systems development (including GIS) should follow a standard system development lifecycle to control risk and produce a high quality product. A generic system development lifecycle process includes the following steps:

- Assessment
  During this process a broad scope is defined and the requirements are gathered/verified and the scope is refined with the outcome that it is okay to proceed (or not). Test cases are developed based on business requirements as well as measures of success. Project manager deliverables are at a high level here.
- Feasibility
  During feasibility the scope is refined to be specific and the project team will be established based on that scope. The technical requirements specifications are done here. The outcome is a determination that it is okay to build. The project team is set up and project management deliverables are established and implemented in this process.
- Build
  During this process the design work is done on the product, any purchasing that needs to be done is completed and the product is constructed. The product is tested and any training that needs to take place is completed.
- Implement
  During this phase the system is implemented into production, maintenance begins and lessons learned can be completed.
- Follow up
  Long-term follow up allows determination if the measures of success are being met and provides a feedback loop for future work. This is particularly important in an iterative process.

The following is a breakdown of the WA-TRANS project into the MPD method using the SDLC process outlined iteratively with a phased approach.

Phase I (Project Assessment and Feasibility)

*Charter*ing the team includes:

- ✓ Reassembling participants and determining which group will be decision makers.
- ✓ Revisiting the project scope and redefining it in business terms without regard to data.
- ✓ Updating the project charter to contain all items under the charter process plus an outline of the project methodology. This is a high level charter that arches over the whole project.

*Plan*ning the work includes:

- ✓ Developing a mini charter for Phase I that is more specific regarding the Phase I scope and deliverables.
- ✓ Developing a detailed work plan and schedule for Phase I.
- ✓ Evaluation Phase I resource needs and determine availability.
- ✓ Developing the project change control plan.
- ✓ Developing the project communication plan.
- ✓ Developing the project issue management and dispute resolution plan.

- ✓ Develop the detailed Phase I budget.
- ✓ Develop the project risk assessment and management plan.

Endorsing the plan includes:

- ✓ Formal approval of the charter with decision-making team.
- ✓ Review of charter with all partners.
- ✓ Review of all project management deliverable with all partners.
- ✓ Formal approval to provide resources as defined in the work plan by affected partners.

Executing the plan includes:

- ✓ Examination of previous work and other framework experience.
- ✓ Verifying previously documented business needs.
- ✓ Performing gap analysis on business needs verified.
- ✓ Gather business needs where a gap in documentation is identified.
- ✓ Extracting and documenting business requirements.
- ✓ Resolve previous work and business requirements with requirements elicited in Phase I.
- ✓ Develop high-level cost-benefit on individual requirements.
- ✓ Develop test cases and measures of success on individual business requirements.
- ✓ Get approval of business requirements.
- ✓ Prioritize business requirements.
- ✓ Develop functional requirements mapping to business requirements.
- ✓ Resolve previous work and functional requirements.
- ✓ Develop a list of pilots.
- ✓ Prioritize pilots based on business requirements.
- ✓ Begin gathering and documenting information about available data.
- ✓ Manage issues and risk through out.

Close Phase I:

- ✓ Develop phase I lessons learned.
- ✓ Get formal approval of Phase I deliverables (which weren't previously approved.)

Phase II (Pilot Build, Implement and Follow-up)

*Charter*ing the team includes:

- ✓ Select Phase II pilot(s).
- ✓ Determine if pilot is a proof of concept.
- ✓ Evaluate membership in decision-makers team for appropriateness regarding pilot selection.
- ✓ Determine scope of pilot(s) and define in business terms.
- ✓ Updating the overall project charter as needed.
- ✓ Develop a mini-charter for Phase II.

*Plan*ning the work includes:

- ✓ Developing a detailed work plan and schedule for Phase II.
- ✓ Evaluation Phase II resource needs and determine availability.
- ✓ Update the project communication plan.
- ✓ Develop the detailed Phase II budget.
- ✓ Update the project risk assessment and management plan.

Endorsing the plan includes:

- ✓ Formal approval of the mini-charter with decision-making team.
- ✓ Review of mini charter with all partners.
- ✓ Review of all work plan, schedule, budget, and resource needs and risk plan with all partners.
- ✓ Formal approval to provide resources as defined in the work plan by affected partners.
- ✓ Establish team for pilot(s) development and implementation.

Executing the plan includes:

- ✓ Document planned approach to pilot(s).
- ✓ Perform required analysis and design for pilot(s).
- ✓ Implement physical test data structure needed for pilot(s).
- ✓ Build utilities needed for pilot(s).
- ✓ Develop any required partner agreements.
- ✓ Develop test plans for the pilot(s).
- ✓ Get appropriate partner approval of test plans.
- ✓ Test pilot(s) based on test plans with appropriate partners.
- ✓ Modify pilot(s) as needed.
- ✓ Implement pilot(s).
- ✓ Evaluate pilot findings.
- ✓ Develop report of pilot findings and recommendations.
- ✓ Continue to identify and document available data.
- ✓ Manage change, issues and risk through out.

Close Phase II:

- ✓ Develop phase II lessons learned.
- ✓ Get formal approval of Phase II deliverables.

Phase III (Project Release 1.0 Build, Implement and Follow-up)

*Charter*ing the team includes:

- ✓ Determine which business requirements will be met by release 1.0.
- ✓ Evaluate functional dependencies to determine which additional functionality should be included in release 1.0.
- ✓ Evaluate membership in decision-makers team for appropriateness regarding release 1.0.
- ✓ Updating the overall project charter as needed.
- ✓ Develop a mini-charter for Phase III.

*Plan*ning the work includes:

- ✓ Developing a detailed work plan and schedule for Phase III.
- ✓ Evaluation resource needs and determine availability.
- ✓ Update the project communication plan.
- ✓ Develop the detailed Phase III budget.
- ✓ Update the project risk assessment and management plan.

Endorsing the plan includes:

- ✓ Formal approval of the mini-charter with decision-making team.
- ✓ Review of mini-charter with all partners.
- ✓ Review of all work plan, schedule, budget, and resources needed and risk plan with all partners.
- ✓ Formal approval to provide resources as defined in the work plan by affected partners.
- ✓ Establish team for development and implementation of release 1.0

Executing the plan includes:

- ✓ Document planned approach to release 1.0.
- ✓ Perform required analysis and design for release 1.0.
- ✓ Design logical data model for WA-TRANS.
- ✓ Implement physical test data structure needed for release 1.0.
- ✓ Build utilities needed for release 1.0.
- ✓ Develop any required partner agreements.
- ✓ Develop test plans for the release 1.0.
- ✓ Get appropriate partner approval of test plans.
- ✓ Test release 1.0 based on test plans with appropriate partners.
- ✓ Modify release 1.0 as needed.
- ✓ Implement release 1.0 and database into production.
- ✓ Establish system maintenance.
- ✓ Manage change, issues and risk through out.

Close Phase III:

- ✓ Develop phase IIII lessons learned.

Phase IV and Beyond

The phases could continue and be revamped as needed based upon priorities, funding and amount of the scope completed. They could have more functionality and data in release 2.0, etc. This iterative approach reduces risk and brings a working product into the partners' hand in a much shorter time frame than trying to accomplish all the deliverables in a single release. Of course, these deliverables would be subject to change based upon business requirements, funding and pilot results. The goal of such an approach though, is to break the project down into manageable chunks, with clearly defined objectives, scope,

requirements, cost, risk and timeline so it can be handled as a single effort and can be more manageable.

Executive Summary

The Washington State Transportation Framework for GIS project (WA-Trans) is a statewide effort to develop a layer of multi-model transportation data that is location based. This means that data is needed from sources across the state and that long term maintenance must be performed on this data to keep WA-Trans a viable and useful product. Successful implementation of such a data set requires resolution of many issues in the organizational, cultural and technical categories. In order to get involvement of the largest set of potential players their needs for this product must be understood. In order to justify any significant involvement in data formatting, sharing and maintenance a business cost benefit justification must be performed. All of this is based upon a complete business needs assessment.

Process Used

Interviews were done with representatives from various organizations across the state to gather initial business needs. Business needs were documented from this process. There was some duplication as a result of semantic differences. The initial document was taken to the WA-Trans Partners Group and the WA-Trans Steering Committee Group to acceptance and feedback. The Steering Committee determined that there were some missing or un-represented groups and an effort was made to reach out to those groups. Each business needs is uniquely numbered, titled, and described. The source of the business needs is identified, the generic business functions, which may share in the business need, are listed and the specific partners who may find a particular business need useful.

Summary Results

These results are summarized by generic business function. There are several business needs and potential business users not covered in this summary due to space limitations.

Transportation Planning: Statewide travel demand modeling using the complete transportation system and the ability to model various years for which data has been collected. This model facilitates development of the Highway System Plan, the 20 Year Transportation Plan and the STIP. This could facilitate true multi-modal analysis. Collision data across the state on all roads and railroad crossings can be analyzed in making decisions.

Environmental Analysis: Facilitates analysis of transportation features in a watershed with no boundary distinctions. Provides data for impervious surface analysis, water crossing on transportation lines and looking at environmental data system wide in relationship to transportation projects. Facilitates communication and analysis of habitat along roadways.

Maintenance of Transportation Infrastructure: Allows for maintenance to analyze interfaces for drainage features data between various transportation agencies statewide. Analysis includes information about how these systems cross various multi-jurisdictional roads systems and affect those roadways. WA-Trans can facilitate maintaining an inventory of features along the roadway statewide. This data can be used for scoping transportation projects and support cross-jurisdictional maintenance service agreements. This data can also be used for rail projects and ferry projects.

Emergency Management and Response: Facilitates coordination of transportation during an emergency including analysis of routes into and out of a disaster area, route closures and detours, and transit organized to move people during a disaster. Facilitates emergency planning including determining infrastructure vulnerability assessment. If addresses are part of WA-Trans it can be used to support the FCC Phase II Mandate for Enhanced 911 emergency response across the state. Supports concept of “lifelines” and an ongoing project of King County Emergency Management to identify lifelines.

Transit and Public Transportation: Facilitate coordinated dispatch and scheduling for demand response rides for disables and needy individuals. Facilitates communication and analysis of park and rides and connecting routes. WA-Trans data is a necessary component of the Trip Planner Project both Oregon and Washington are working on.

Freight Mobility Planning and Management: Supports information regarding navigable waterways and port facilities. Much freight is transported by barge and rail as well as truck. There is traffic along the Columbia and Snake rivers, which would otherwise be shipped by truck or rail. Also facilitates analysis of geo-coded truck flows. Tracking truck traffic across the state including information about truck configurations, origins, destinations and specific routes can be used for highway planners and others.

Cross-governmental Communication: One of the main themes across business needs was the need for significantly better communication between agencies of the same level of government and between levels. Examples of this include communicating project plans between jurisdictions, particularly when there are coordination requirements, collecting and providing collision data to local jurisdictions and tribes via GIS for locating them, sharing bridge data sharing between various road authorities, communication activities along the roadway including utilities work and other work. This facilitates coordination of paving and other activities when done in the earlier planning stages.

Public Communication: Facilitates communicating projects to the public, without regard to jurisdictional boundaries, supports Puget Sound Traffic Flow Map being expanded beyond the state highway system. This would also support answering customer calls about activities on all roadways in a more coordinated manner.

Future Use

This data has been entered in a relational database and partners are prioritizing the business needs as well as identifying data needed to support the business needs. A determination is being made regarding what data is actually available so decisions can be made regarding what business needs to pilot and where pilot projects should be performed. Ultimately this information will be used to determine the scope of the various implementation phases of the project. This data will also be used to perform business cost/benefit analysis.

Introduction

This document outlines the business needs identified for the Washington Transportation Framework Project (WA-Trans). It provides high-level context information and then business needs in enough detail that business requirements may then be derived. The needs are identified by the function, which will use them. The documentation includes the source of the identified need as well as the specific partners who may share the need or contribute to meeting the need. Business needs are defined as economic drivers for participating in the activity of developing WA-Trans. They also are beneficial outcomes of WA-Trans if it is designed to facilitate meeting the various business needs

Background

The transportation framework is one theme of the total framework concept. In the 1990s it was recognized that the cost of producing Geographical Information Systems (GIS) data was prohibitively high and that duplicate data was proliferating. In an effort to be more efficient the framework concept was born for GIS in the Federal Geographic Data Committee (FGDC). There are several themes, of which transportation is one. Other themes identified by the FGDC include elevation and bathymetry, hydrography, geodetic control, cadastral, government units and orthoimagery. The goal is for these themes to work together to provide a complete picture of the geographic data.
The Washington Geographic Information Council (WAGIC) has sponsored efforts to work on specific themes in the state of Washington. Efforts have been made in the cadastral, hydrography and orthoimagery themes. The transportation effort is not a new one, but it has new momentum with a full-time project manager and a new effort at formally defining business needs, requirements and functional specifications. This document defines business needs.

Vision

The Washington State Transportation Framework is a seamless set of data that are consistent, connected, and continuous between segments of the transportation framework and with other framework layers. The transportation framework represents the best data available and includes mechanisms to improve over time. Framework data is accessible to the general public at the least cost with the least restrictions.

Business Opportunity

It is expected that this document will completely outline the different business opportunities. These opportunities can be divided into specific business functions. Functions which derive a business opportunity for the transportation framework include: Transportation Planning, Emergency Management Planning, Emergency Management Routing, Transportation Project Scoping, Transportation Project Design, Transportation Project Construction, Transportation Operations, Transportation Maintenance, Emergency First Response, Environmental Impact Analysis, Freight Routing, the Trip Planner Project and others. WA-Trans will allow for sharing of data and reduce the duplication of data. It will also facilitate data consistency across the state.

Value Provided to Customer

The customer will have access to data regarding various modes of transportation including roads, rails, airports, ferry terminals and routes and ports for the whole state. They will have the ability to attach their own data to this so they can see their data in relationship to the statewide transportation systems. The customer will be able to rely on transportation data outside their own jurisdiction when developing applications. The framework will provide a standard, which will facilitate data exchange. The ability to do this exchange will increase business opportunity and reduce costs of duplicate data production and data inconsistency.

Business Risk

A complete separate risk assessment is being developed and maintained. Some key risks include: Lack of stakeholder participation leading to a standard and framework that won't be used, lack of resources and funding at key stages to complete the work, making the framework serve too many specialized functionalities, thus leading to high risk of failure or a framework which is too specialized to be universally useful. There are many other risks that are included in the risk assessment. The major risk of not developing this framework is the significant cost of duplication of data, the costs resulting from incorrect data, and the lost opportunity of being able to utilize cross jurisdictional data in a cost effective manner for applications.

Assumptions

1. Sufficient partners representing data providers and data users participate in the project. The exact number is uncertain, but there should be a representative participation from the various groups who will be primary data providers and/or primary business users of the product.
2. Funding and resources are available from partner organizations for a project manager, data modeling, software development and maintenance.
3. Key staff resources with the necessary technical ability are available and can be scheduled to complete project tasks. While it is not yet possible to completely define the technical ability required it is assumed that when this is defined the ability will exist to provide or acquire these resources.
4. Agreement can be reached on a common data model.
5. Agreement can be reached on a common linear referencing system if one is needed.
6. Technical capabilities of the software, hardware, and resources are available to support business needs.
7. A phased approach will be utilized to develop the framework incrementally.
8. Existing infrastructure will be used to make transportation framework data accessible.
9. The transportation framework project and other framework projects will be coordinated.
10. The first implementation of the framework will be simple and a plan will exist for increasing complexity and functionality over time.

11. Sufficient business value will be discovered and documented to compel participation in building, using and maintaining the WA-TRANS.
12. Pilot test results will represent the statewide situation enough to use these results to determine approaches.
13. When pilots are successful the results will become part of the framework implementation.
14. Negotiation, compromise and facilitation will be utilized to arrive at implementation priorities. Funding source may be considered a key issue in deciding such priorities.
15. A steering committee will be organized for the project that will have the authority in their individual organizations to access resources and possibly funds to assist with the various phases of the project. The size of this steering committee will be dependant upon what is required to get adequate representation for different business areas. However at this time it is hoped that steering committee will be limited to 13 members including the project manager.
16. Membership of the steering committee may change as phase deliverables change.
17. The steering committee will be able to participate to the level of providing detailed analysis and decision-making about business requirements, functional requirements and prioritization of requirements. The steering committee will also be available at least once a month for meetings in order to facilitate change management and issue management.
18. The steering committee will be representative of the Washington Transportation Framework Stakeholder Group.
19. The steering committee will be small enough to facilitate effective decision-making.
20. Any project plans for implementation will include plans and funding sources for maintenance of what is implemented.
21. WAGIC and FMG will assist with pursuing funding.

Scope and Limitations

Scope of the Initial Release

To be determined by the WA-Trans Steering Committee.

Scope of Subsequent Releases

To be determined by the WA-Trans Steering Committee.

Limitations and Exclusions

To be determined by the WA-Trans Steering Committee.

Customer Profiles

The project has various customers, which have been identified. There have been several customer categories identified. However, this data has wide usefulness and many potential customers may remain unidentified. Specific customers participating or providing input to this document both outside and in WSDOT are identified. Customers identified so far include:

Federal Agencies include:

US Bureau of Land Management,
US Bureau of Indian Affairs
US Census Bureau,
Federal Highway Administration,
US Department of Energy (Hanford)
US Forest Service,
National Parks Service
US Geological Survey.

Washington State Agencies and organizations include:

Center to Bridge the Digital Divide at WSU,
County Road Administration Board,
Department of Natural Resources,
Eastern Washington University Tribal Technical Assistance Program
Enhanced 911,
State Parks,
Utilities and Transportation Commission,
Washington Geographic Information Council (WAGIC),
Framework Management Group,
Strategic Freight Transportation Analysis Project (SFTA),
Freight Mobility Strategic Investment Board (FMSIB)
Office of the Superintendent of Public Instruction
Information Services Board Geographic Information Technology Subcommittee
Department of Transportation (WSDOT),

Divisions or functions within WSDOT specifically interested at this time include:

Aviation Office
Bridge Preservation Office,
Design Office,
Emergency Management Office,
Environmental Affairs Office,
Freight Strategy and Policy Office
Government Liaisons (Tribal Liaison),
Highways and Local Programs,
Interactive Transportation Systems (TRAC),

Program Management Office
Planning Office,
Public Transportation Office,
Rail Office,
Regional Project Engineers office (Scoping function),
Transportation Data Office (TDO),
Transportation Demand Management Office,
T2 Program,
Urban Corridors,
WSF Council for Disaster Planning,
WSF Terminal Engineering.

Tribal Nations include:

Jamestown S'Klallam Tribe,
Makah Tribe,
Muckleshoot Tribe,
Quinnault Indian Nation
Samish Tribe,
Stillaguamish Tribe,
Tulalip Tribe.

Local organizations include:

Association of Washington Cities,
Benton-Franklin Council of Government (COG),
Benton County
City of Kennewick
City of Monroe,
City of Pasco,
City of Seattle (DOT and Public Utilities),
City of Spokane,
City of Tacoma,
Clallam County,
Clark County,
Community Transit (Snohomish County),
Douglas County,
Franklin County
Island County,
Ferry County,
King County Emergency Management,
King County Metro (T-Net Project),
Kitsap Transit,
Lewis County
Lincoln County,
Mason County,
Pend Orielle County,
Pierce County,

Port of Seattle,
Puget Sound Regional Council,
Skamania County (Sheriff's Office E-911)
Spokane County,
Stevens County,
Thurston County,
Yakima County,
Yakima Valley Council of Governments (COG)
Walla Walla County,
Whatcom Council of Government (COG).

Private Organizations include:

Environmental Systems Research Institute Inc. (ESRI),
Green Crow Management Services
Longview Fibre,
Weston Solutions,
Washington Forest Protection Association.

Project Priorities

To be set by WA-Trans Steering Committee.

Project Success Factors

Establish broad participation.

Identify and recruit partners who:
Can identify a business case for investing in the transportation framework,
Represent a range of uses of the database,
Are needed to create full data coverage.

Establish standards, which enhance the will and ability of partners to collect and maintain the data.

Match the standard to the ability of the partners to collect and maintain the data.
Identify a standard which allows data quality to improve over time.
Identify funding incentives for partners to participate.

Provide the data needed to meet business and analytical needs.

Data must be:
Accurate.
Complete.
Not too complicated to use.
Described and documented.
Up-to-date.
Relevant to business and analytical needs.
Data must be digital

Formatted in open standard, relational structure
Able to be imported into commercial digital mapping systems.

Define a data model that partners agree meets their needs.

Identify business needs and functional requirements, and define the data needed to support them.
Examine existing data models.
Seek consensus agreement on the data model. Partners commit to achieving consensus.
Provide frequent and on-going communication of progress and decisions to partner organizations.

Identify the right standards and processes.

Identify standards and processes needed to meet business needs.
Examine existing standards and processes.
Identify standards and processes needed to facilitate integration of data from multiple sources.
Identify standards and processes, which facilitate maintaining the data long term.

Identify standards and processes that recognize the capabilities of existing technology to support the standards and processes.

Identify standards and processes that recognize the capabilities of existing technology to support the standards.
Provide tools for data integration, data access, and metadata.

Phased Development

Set the scope of phases to allow delivery of tangible products within a set time frame.
Use phases as a method of showing an effort and plan to meet all business needs while focusing on the ones, which can most realistically be met at the current time.

Business Needs

The business needs are defined as high level needs described in business terms. Each business needs is documented as follows:

Business Need: This is a number assigned to each business need. At this point these number are subject to change. When stakeholders approve business needs as substantially complete or correct a "permanent" number will be assigned with room to insert new numbers if needed.

Title: The title is a short descriptive name used to identify the need.

Description: This is a description of the business needs described in business language to be understandable to most who may read it. It includes enough detail to extract business requirements from.

Business Functions Using: This is a list of generic business functions that may use WA-Trans to assist in meeting this need. It is not defined by specific organizations.

Source: The provider of the original business needs identified.

Specific Partner Use: This is similar to the "Business Function Using" except it identifies a specific partner involved in WA-Trans who may find using WA-Trans to assist with meeting this need useful.

Business Need
1

Title
Communication of Survey Data

Description
Project Engineers involved in scoping and designing a project (transportation infrastructure) would like to know what areas have been surveyed by county and local governments and other parts of WSDOT and access to that data to avoid resurveying the same area.

Audience
WSDOT, County Governments, City Governments, Transit Organizations

Function
Public works, Transportation Construction Projects, Transit Organizations

Source
WSDOT Olympic Region Lacy Project Engineers Office

Business Need
2

Title
Future Plans for Transportation Infrastructure

Description
Organizations need to know the plans of other organizations regarding building or modifying transportation infrastructure including sidewalk plans as soon as they were estimated and this data needs to be geocoded. Information needs to include road segment or structure involved. This would facilitate communication and help planning in a more proactive and mutually supporting way's

Audience
WSDOT, Counties, Cities, E-911, Puget Sound Regional Council, Federal Highway Administration, Bureau of Census

Function
Public works, Transportation construction projects, Business developers, E-911, Transit organizations, Census related organizations

Source
WSDOT Olympic Region Lacey Project Engineers Office, WSDOT Environmental Affairs Office, WSDOT Olympic Region Highway and Local Programs Engineer, WSDOT Highways and Local Programs, WSDOT Ferry Terminal Engineering, City of Seattle DOT.

Business Need
3

Title
Railroad Line Information

Description
A variety of information about rail lines is needed. Included in this is: track locations, Where tracks intersect roads, What type of crossing controls there are at intersection, Safety rating of intersection, Whether the track is abandoned or active, Location of rail bridges, tunnels and potential mud slides locations along railways, Ownership of rail lines (specific tracks). Where tracks intersect streams (BOC) Location of Inter-modal Loading Facilities (Truck-Rail, or Rail-Barge) the amount and general type of freight carried per segment and average trip time for freight trains on various segments.

Audience
WSDOT, Counties, Cities, E-911, Puget Sound Regional Council, Bureau of Census, Strategic Freight Transportation Analysis Project, Utilities and Transportation Commission

Function
Public works, Transportation construction projects, Planning, E-911, WSDOT Bridge Preservation Office, Metropolitan Planning Organizations, Regional Transportation Planning Organizations, Emergency Management, WSDOT Transportation Data Office, WSDOT Rail Office

Source
WSDOT Olympic Region Lacey Project Engineers Office, WSDOT Rail Office, WSDOT Bridge Preservation Office, Strategic Freight Transportation Analysis Project; WSDOT Freight Strategy & Policy Office

Business Need
4

Title
Communication of Recently Completed Projects Along the Roadway

Description
Data on specific projects recently completed which could be queried by a specific time frame and location.

Audience
WSDOT, Counties, Cities, E-911, Puget Sound Regional Council, Federal Highway Administration, US Geologic Service

Function
Public works, Transportation construction projects, Business developers, Emergency response, Transit organizations

Source
WSDOT Olympic Region Lacey Project Engineers Office, WSDOT Urban Corridors Office, City of Seattle Department of Transportation

Business Need
5

Title
Routing

Description
There is a need for evaluating and mapping alternate routes for a variety of functions on all roads including county, city, state and private roads. This includes the need to buffer an affected area for analysis. This would be used for emergency management, traffic

control, homeland security, freight congestion, infrastructure impact analysis and transportation construction projects. Routes to reduce freight congestion. There is also a need to communicate alternate routes to the public.

Audience
WSDOT, Counties, Cities, E-911, Freight Mobility Strategic Investment Board, Strategic Freight Transportation Analysis Project

Function
Public works, Transportation construction projects, Emergency management, Transit organizations, Military, Public utilities, Freight

Source
WSDOT Olympic Region Lacey Project Engineers Office, WSDOT Emergency Response, WSDOT Olympic Region Highway and Local Programs Engineer, WSDOT Ferry Terminal Engineering, City of Seattle Department of Transportation, Strategic Freight Transportation Anal

Business Need
6

Title
Impervious Surfaces Analysis Data

Description
Information that facilitates calculating impervious surfaces along existing roadways such as pavement type, surface area and other related things would assist with the impervious surface permits. Impacts to impervious surfaces due to heavy freight loads contribute to this. There is additional data needed that may not be part of WA-Trans. This data is covered in the section of data needs from other frameworks.

Audience
WSDOT, Counties, Cities, Transit organizations, Freight Mobility Strategic Investment Board, Strategic Freight Transportation Analysis Project

Function
Public works, Transportation construction projects, Transit organizations, freight

Source
WSDOT Environmental Affairs Office, City of Seattle Department of Transportation, WSDOT Freight Strategy & Policy Office

Business Need
7

Title
Water crossing roadways

Description
Locations of water crossing on roadways including permanent and intermittent water and 100 year flows of streams and rivers. This data is used for scoping and design of highway projects. This may be considered hydro data but relates to culverts and bridges.

Audience
WSDOT, Counties, Cities

Function
Public works, Transportation construction projects, Environmental permitting organizations, Business developers

Source
WSDOT Environmental Affairs Office, WSDOT Design Office

Business Need
8

Title
Facilitates Collision Analysis using Transportation System

Description
There is a need to provide analysis of roadway collisions based upon the whole roadway system surrounding the incidents including off and on ramps, roads signals, and structures connecting to the roadway. May involve roads and infrastructure outside of a specific jurisdiction. It would be useful if the data for freight vehicles could be available separately.

Audience
WSDOT, Metropolitan Planning Organizations, Regional Transportation Planning Organizations, Public Works, Emergency Management, Federal Highway Administration, Transit Organizations

Function
Transportation planning, Emergency response, Transit organizations

Source

WSDOT Olympic Region Highway and Local Programs Engineer; WSDOT Freight Strategy & Policy Office

Business Need
9

Title
20-Year Transportation Plan Development

Description
Developing a 20-year plan involves using transportation plans data statewide as well as a variety of other data. This other data will be included in the data sections of this document.

Audience
WSDOT, Puget Sound Regional Council, County Road Administration Board, Counties, Cities, Freight Mobility Strategic Investment Board, Strategic Freight Transportation Analysis Project

Function
Transportation planners, Urban planners, Private developers, Government agencies, Program managers

Source
WSDOT Planning, WSDOT Olympic Region Highway and Local Programs Engineer, WSDOT Ferry Terminal Engineering

Business Need
10

Title
Tracking Activities along Transportation Network by Organizations without Jurisdictional Responsibility

Description
The specific need identified was stated as “Knowing when and where utilities plan to work so we can combine paving efforts.” This can be extended into know plans regarding work on or alongside any transportation feature that is not being done by the organization which generally maintains that feature.

Audience
WSDOT, Counties, Cities

Function
Public works, Maintenance and operations organizations

Source
WSDOT Olympic Region Highway and Local Programs Engineer

Business Need
11

Title
Communicating improvements to the roadway

Description
This was stated as a “need to know when another agency or developer makes improvements on a state highway system. This information is captured if the improvement is connected to an interstate or if they use WSDOT to award the contract. Otherwise the information isn’t captured.” This could be extended to needing to know when ANY organization makes an improvement to ANY road on the network. This actually encompasses maintenance, accuracy and timeliness of data.

Audience
WSDOT, Counties, Cities, Puget Sound Regional Council, County Road Administration Board, Freight Mobility Strategic Investment Board, Strategic Freight Transportation Analysis Project

Function
Transportation planning, Project scoping, Project design, Road maintenance, Road operations, Urban planning, Business planning, Emergency management, Emergency response

Source
WSDOT Olympic Region Highway and Local Programs Engineer, WSDOT Transportation Data Office, City of Seattle Department of Transportation, WSDOT Freight Strategy & Policy Office

Business Need
12

Title
Statewide Base Map to use in Communication

Description
There is a need for a statewide base map that extends beyond jurisdictional boundaries

to illustrate scenic byways and provide communication for funding with the legislature, local partners, and the Federal Government.

Audience
WSDOT, Counties, Cities, Puget Sound Regional Council

Function
Planning, Program Management, Public Communications

Source
WSDOT Olympic Region Highway and Local Programs Engineer, WSDOT Program Management, WSDOT Rail Office

Business Need
13

Title
Coordination of Transportation During Emergencies

Description
In the Washington State Comprehensive Emergency Response Plan it is WSDOT's responsibility to coordinate all transportations (all modes, all routes) for the state. The Agency must collect information about closures and routing. During the Nisqually Quake the Governor asked for maps including alternate routes. There is a need for a method of collecting, storing and illustrating areas of closure and alternate routes. This requirement can be extended to include a mechanism for storing and communicating all closures in various situations including terrorist attacks, natural disasters or construction.

Audience
WSDOT, Counties, Cities, E-911, Emergency Management

Function
Emergency management, Emergency response, Transportation maintenance, Transportation operations, Transit organizations, Military

Source
WSDOT Emergency Response, WSDOT Council for Disaster Planning, King County Emergency Management

Business Need
14

Title
Transportation Infrastructure Vulnerability Assessment

Description
There is a need to perform vulnerability assessments on transportation infrastructure statewide based on critical risk. It must breakdown each feature by ownership, then functionality, and then relationship to other things (ex. emergency routes, etc.) It must look at multi-hazard vulnerabilities. Then an alternative analysis must be performed. WA-Trans could be the basis for such an assessment and used to continually update the assessment based on new risk models and new data.

Audience
WSDOT, Counties, Cities, Emergency Management

Function
Emergency management, Emergency response, Transportation operations, Transportation planning, Risk management

Source
WSDOT Emergency Response, WSDOT Council for Disaster Planning

Business Need
15

Title
Facilitate Bridge Data Sharing Between Various Road Authorities

Description
There is a variety of bridge data needed statewide. The WSDOT Bridge Preservation Office is federally mandated to report on bridges statewide. The extent of this mandate includes city, county, state and some privately owned bridges with public traffic. They are responsible for inspections on regular inventory, which includes big interchanges, bridges over dry gulches, other raised highways and anything over water and all tunnels. They are responsible for movables, and specialized structures such as the Narrows and floating bridges. They need to know the following about bridges: Location of bridges and structures (tunnels, etc), Cross streets close to bridges, Stream or water body names, Proximity of bridge to railroad, Mechanism to share bridge inspection status, type, frequency, due dates, whether navigable water, location with counties and cities, Need structural bridge information from counties which shows up on statewide map Need information from local governments to assist in bridge prioritization for repair or retrofit in situation of disaster (ex. earthquake) where many may need to be repaired/retrofitted at once. Need information about egress routes into tribal lands and structures on them Need data from Federal Government about backcountry bridges for their inventory Cities and counties would like a better mechanism for sharing bridge data with WSDOT and better access to WSDOT data about bridges within their

jurisdiction that they don't have jurisdiction over.

Audience
WSDOT, Counties, Cities, E-911, US Geological Survey, US Forest Service, US Bureau of Land Management

Function
Public works, Transportation maintenance, Transportation operations, Emergency management

Source
WSDOT Bridge Preservation Office, City of Seattle Department of Transportation

Business Need
16

Title
Facilitate Developing Travel Demand Forecasting Models

Description
Travel demand forecasting is a process of building models to use in decision support. Currently MPOs build their own models. WSDOT needs to build a model that would connect to their models. It would require information on local, county and state roads, rail, air, ferry, freight and transit routes. This would be used for long range planning. It would also be useful in analysis of "environmental justice" issues with transportation planning.

Audience
WSDOT, Counties, Cities, Puget Sound Regional Council, Transit Organizations, Freight Mobility Strategic Investment Board, Strategic Freight Transportation Analysis Project

Function
Transportation planning, Urban planning, Business planning, Communication

Source
WSDOT Planning Office, WSDOT Environmental Affairs Office, Strategic Freight Transportation Analysis Project, WSDOT Freight Strategy & Policy Office

Business Need
17

Title

Building the Highway System Plan

Description
The agency builds the Washington Transportation Plan periodically. Part of it is the Highway System Plan (HSP). Developing the plan involves collecting all transportation data from all modes and identifying deficiencies based on service objectives and outcome statements. Data collected includes project information, proposals, locations, deficiencies and segments. Ideally they would like to include data collected from locals and counties so they can develop corridor plans and raw development plans. There could be land issues, modeling needs, new development needs and local transportation circulation issues that come into plan. Delay and deficiencies are measured based on all of this information and then the plan is developed. It would be useful to have a specific focus on developing freight corridors and routes.

Audience
WSDOT, Counties, Cities, Puget Sound Regional Council, Transit Organizations, Strategic Freight Transportation Analysis Project, Federal Highway Administration

Function
Transportation planning, Urban planning, Business planning

Source
WSDOT Planning Office, Strategic Freight Transportation Analysis Project, WSDOT Freight Strategy & Policy Office

Business Need
18

Title
Representations with bi-directional carriageways

Description
WSDOT Transportation Data Office locates features and other things along the roadway. There is currently great inaccuracy because the roadway is represented with one centerline and the actual routes that are separated and different in each direction are not accurately represented and lead to bad data when locating features and other things along the roadway. They need bi-directional carriageways with measurements in each direction.

Audience
WSDOT, Counties, Cities, Strategic Freight Transportation Analysis Project

Function
Transportation planning, Project scoping, Project design, Communication,

Transportation data collection, Public works, Transportation maintenance, Transportation operations

Source
WSDOT Transportation Data Office

Business Need
19

Title
Collecting Collision Data and Locations

Description
The WSDOT Transportation Data Office collects data and performs collision reporting and tracking where collisions occur on specific highways. Eventually WSP and other police vehicles will be outfitted with GIS to report the location of collisions. Data used for analysis about problems that cause collisions. Freight interests needs to know where truck accidents occur to identify unsafe conditions and problem locations.

Audience
WSDOT, Counties, Cities, Transit Organizations, Washington State Patrol

Function
Transportation operations, Transportation maintenance, Transportation planning organizations, Transit organizations, Police, Emergency response

Source
WSDOT Transportation Data Office, WSDOT Freight Strategy & Policy Office

Business Need
20

Title
Providing Collision Data to Local Governments

Description
The WSDOT Transportation Data Office provides traffic accident and collision data to counties. They also provide history at intersections of local and county roads with state routes. The provide data to MPOs and RTPOs for their models. All of this sharing could be facilitated through the Transportation Framework. Cities need this data.

Audience
WSDOT, Counties, Cities, Puget Sound Regional Council, Strategic Freight

Transportation Analysis Project, Transit Organizations

Function
Transportation Planners, Public Works, Transit Organizations

Source
WSDOT Transportation Data Office, City of Seattle Department of Transportation

Business Need
21

Title
Work with HPMS/FC replacement

Description
The Highway Performance Monitoring System and Functional Classification Systems are maintained by WSDOT for the FHWA. This is database of all miles of public roads in the State. It is the basis for determining eligibility for Federal-aid funding for functional classification modifications and updates as well as the basis for designation of the National Highway system. WSDOT is mandated to maintain data about out all roads in both rural and urban areas and determine the functional usage of existing roads and streets. These systems get data from many of the partners that WA-Trans will. Aligning these systems with WA-Trans would prevent unnecessary duplication of data and effort. Collecting the same data once would facilitate sharing from local governments. There is an effort to replace them with a single system and this is where alignment might best be facilitated. This effort wants a functional class map, which shows all roads and road miles included in the functional classifications sent to the Federal Government. It is hoped that WA-Trans and HPMS/FC replacement will facilitate the exchange of road information between cities, counties and the State.

Audience
WSDOT, Counties, Cities, Federal Highway Administration, County Road Administration Board, Metropolitan Planning Organizations, Regional Transportation Planning Organizations, Strategic Freight Transportation Analysis Project

Function
Government transportation organizations

Source
WSDOT Transportation Data Office, City of Seattle Department of Transportation

Business Need
22

Title
Support the "Trip Planner" Project effort

Description
The WSDOT Public Transportation Office is working on an effort called "Trip Planner" that ultimately involves providing the public with information about what transportation options are available from one location to another. It involves routing, transit information and is anticipated to be web based. Initially the project focuses on getting information on fixed routes systems. Then it will work on getting information about demand response and other transportation. Eventually would become a doorstop-to-doorstop trip planner anywhere in the state. This project depends on a statewide base map with addressing and routing for multiple modes. The project will server all commuters who use public transportation and would be particularly useful to social services and others who plan transportation for ADA and low income individuals.

Audience
WSDOT, Kitsap Transit, Community Transit

Function
Social Services, Chamber of Commerce, Employment organizations, Commute Trip Reduction, Transit systems

Source
WSDOT Public Transportation Office, WSDOT Transportation Demand Management Office

Business Need
23

Title
Communicate and Analyze Transportation Features in a Watershed

Description
Environmental analysis frequently is done on the basis of a watershed, which is not always bounded by a single transportation jurisdiction. This analysis requires all transportation features to be included. This includes footpaths, bike trails, forest roads, and other less-used transportation features.

Audience
WSDOT, Counties, Cities, Washington Department of Natural Resources

Function
Environmental assessment, Permitting, Transportation construction programs, Program management, Transportation planning

Source
WSDOT Environmental Affairs Office

Business Need
24

Title
Communicate and Analyze Habitat Along Roadway

Description
In order to evaluation the evolution of the habitat relationship with the roadways “habitat connectivity” infrastructure may need to be part of WA-Trans.

Audience
WSDOT, Counties, Cities, Washington Department of Natural Resources

Function
Environmental assessment, Permitting, Transportation construction programs, Program management, Transportation planning

Source
WSDOT Environmental Affairs Office

Business Need
25

Title
Communicate and Analyze Park & Rides and Connecting Routes

Description
WA-Trans should include Park & Rides, including lights and pavement conditions by location; they need data regarding Park & Rides. Need to analyze direct access to and from Park & Rides to other systems. Not all Park & Rides belong to WSDOT or are maintained by them. The City of Seattle Department of Transportation manages a car pool parking program that may also be useful as part of sharing data about Park & Rides.

Audience
WSDOT, Counties, Cities, Puget Sound Regional Council, Kitsap Transit, Community Transit

Function

Transportation planning, Transit, Transportation construction programs, Commute trip reduction, Employment organizations

Source
WSDOT Program Management, WSDOT Urban Corridors, WSDOT Transportation Demand Management Office, City of Seattle Department of Transportation

Business Need
26

Title
Communicating Project Plans with Public, Various Road Authorities and Other Stakeholders

Description
WSDOT Urban Corridors projects have co-lead agencies. The leads are jointly responsible for the project. These projects are multi-modal. They also are sharing data with differing levels of government and different modes. Generally hiring a contractor who collects the data for scoping does data collection and then it is thrown away. There is not a place to update data. Each project costs between $15,000 and $20,000. Additionally there is a need to share Transportation construction project plans with the public and with developers. Providing maps with the data and showing it in relation to where they live/work has the most impact.

Audience
WSDOT, Counties, Cities, Puget Sound Regional Council, Kitsap Transit, Community Transit

Function
Transportation planning, Public works, Public communications, Transit, Program management

Source
WSDOT Urban Corridors, WSDOT Program Management

Business Need
27

Title
Integrate Multi-modal Transportation Options

Description
This was stated as “Integrating WSF terminal data with roads, bike paths, rails, bus

systems, water-based travel that leads to ferry terminal including traffic data". And "need to be able to evaluate how arterials and ferry terminals interface with the State roadway system and how traffic is moved between them". This need could be extended to say that all modes need to be combined for analysis of transportation patterns for transportation planning.

Audience
WSDOT, Counties, Cities, Puget Sound Regional Council, Kitsap Transit, Community Transit

Function
Transportation planning, Transit

Source
WSDOT Ferry Terminal Engineering, WSDOT Urban Corridors

Business Need
28

Title
Data for Terminal Planning Analysis and Communication

Description
Washington State Ferries is considered part of the state highway system. When they are looking at modifying or building a terminal they need a great deal of data. They need to know the roads and other transportation converging on a location.

Audience
WSDOT

Function
Transportation planning, Ferry planning

Source
WSDOT Ferry Terminal Engineering

Business Need
29

Title
Notification of Ferry Neighbors

Description

WSF needs address and routing information for businesses and homes around ferry terminals for notification purposes when there is closure, noise or some special transportation issue.

Audience
WSDOT

Function
Washington State Ferries, Emergency Management

Source
WSDOT Ferry Terminal Engineering

Business Need
30

Title
Mapping, Analyzing and Communicating Traffic Flow

Description
WSDOT has an application on the Internet called the Puget Sound Traffic Flow Map, which gets heavy usage. It would be very good to expand the boundaries of this beyond the state highway system and show other congestion. The drivers don't care who is responsible for the road. They just want to know where to avoid. Specific information about freight flows would be very useful to freight and freight planning.

Audience
WSDOT, Counties, Cities, Kitsap Transit, Community Transit, Strategic Freight Transportation Analysis Project

Function
The public

Source
WSDOT IT (TRAC) Office, City of Seattle Department of Transportation, Strategic Freight Transportation Analysis Project, WSDOT Freight Strategy & Policy Office

Business Need
31

Title
Coordinated dispatch of on-demand transportation

Description
There is a need for social service providers to facilitate coordinated dispatch and scheduling for demand response rides provided for ADA individuals. There is a need to link trips on demand using a pool of different transportation providers and routes for a particular day so transportation can be arranged as needed with a single call. The idea is to provide a call center for this purpose.

Audience
WSDOT, Counties, Cities

Function
Social Services, The public

Source
WSDOT Public Transportation Office

Business Need
32

Title
Drainage system features and routes from all roadways

Description
There are many potential interfaces for drainage feature data to be shared between the WSDOT and county and city government organizations. When there is a chemical spill on the roadway local jurisdictions need to know the drainage so they can determine the impact to their water, lands and emergency services. Some of WSDOTs culverts and other drainage features cross county and municipal roads and their state of repair affects the roadway they cross. This information is also used to plan for emergencies with local fire and police. There is also county and municipal drainage that goes into WSDOT right-of-way, roadways and other transportation features that impact WSDOT maintenance. Another use of this information is during project scoping both by WSDOT and county and city public works. Drainage feature information is needed along the roadway and where it goes is also needed.

Audience
WSDOT, Counties, Cities, Washington Department of Ecology

Function
Public works, Emergency services, Washington Department of Ecology, WSDOT

Source
WSDOT Maintenance and Operations

Business Need
33

Title
Inventory data of features along the roadway

Description
This is a fixed Asset Inventory – GASB 34 Compliance (General accounting requirements for Road Authorities). While this is largely an internal function there are roadway features that belong to WSDOT that are located off the state highway system and off WSDOT right-of-way. Most freeway ramp intersections have one set of traffic signals owned by WSDOT and the other owned by the controlling local municipality or county. These items need to be located and this data shared. Also WSDOT make arrangements for municipalities to maintain features on some state routes through that city. An example of this is the service agreement with the city of Federal Way to maintain drainage features along SR99 through Federal Way. WSDOT needs to track maintenance of these items. There are also county and city features along the state road system that may require the same information for those agencies.

Audience
WSDOT, Counties, Cities

Function
Public works, Engineers, Maintenance, Asset management

Source
WSDOT Maintenance and Operations

Business Need
34

Title
Snow removal routes and features along the route

Description
WSDOT does snow removal work for the National Parks and State Parks. They have responsibilities regarding care of specialized guard rails along the routes that are owned and maintained by the parks service but can be affected by the plowing. Tracking these routes and features and sharing data with the State and National Parks to do so would be useful.

Audience
WSDOT, Washington State Parks, National Parks Service

Function
Park services road maintenance, state maintenance

Source
WSDOT Maintenance and Operations

Business Need
35

Title
Information about activities on all roadways to answer customer calls

Description
Many taxpayer and others with questions are comments about roads don't know about local transportation organization but they do call WSDOT or vise versa. It would be very helpful to have data about roads closing, contacts in other organizations, roadways and features for answering questions without regard to jurisdiction.

Audience
WSDOT, Counties, Cities

Function
Public communications, chamber of commerce, Counties, Cities, WSDOT, Washington State Patrol

Source
WSDOT Maintenance and Operations

Business Need
36

Title
Mapping using Address Matching

Description
A fundamental use of the transportation network will be location determination by address. Virtually every agency/party employing GIS technology has some need to geo-code data to a street address. Many address data structures exist. A viable and widely employed model might be that used by the U.S. Census Bureau for TIGER.

Audience
Transit, Counties, Cities, King County Emergency Management, Washington E-911, Bureau of Census, WSDOT

Function
Transit, Counties, Cities, Emergency Management, E-911, Economic Development, Census Gathering and Analysis, Transportation Planning, Public Communication, Environmental Analysis, Utilities

Source
Community Transit, Seattle Public Utilities

Business Need
37

Title
Map Production

Description
Organizations must meet the need to produce basic cartographic products. This functionality includes geometry, accuracy, and topological integrity.

Audience
Federal Government, State Government, Regional Government, Local Government, Public

Function
Base Mapping, Public records

Source
Counties, Cities

Business Need
38

Title
Roads Inventory to CRAB (County, Tribal, City, State)

Description
County Road Authorities maintain records of maintained roads with inventory information (pavement type, pavement width, functional classification, ADT) that is used to determine gas tax allocation. BIA is also collecting an inventory of Tribal Roads City Roads, County and State inventory is needed for Federal Classification. This data would be useful for freight planning

Audience

WSDOT, Counties, County Road Administration Board, Federal Highway Administration, Bureau of Indian Affairs, Tribal Government, Strategic Freight Transportation Analysis Project

Function
Public works, County Engineers, Transportation construction projects, WSDOT Transportation Data Office, Bureau of Indian Affairs, Tribal Governments, Federal Highway Administration, Freight

Source
Counties

Business Need
39

Title
Event Location Analysis and Mapping (Geocoding/Address-matching)

Description
Various event databases are maintained which reference street addresses or Road Number and Milepost. Mapping and analysis of these events is critical to management of transportation resources.

Audience
WSDOT, Counties, Cities, County Road Administration Board, Strategic Freight Transportation Analysis Project, Public Access

Function
Public works, County Engineers, Transportation construction projects, Project Scoping, Project Design

Source
Counties

Business Need
40

Title
Public Access to Records

Description
County Road Authorities are statutorily required to keep records of all roads within their jurisdiction, and to provide those records to the public.

Audience
Counties

Function
County Engineers

Source
Counties

Business Need
41

Title
Coordinate Ferries Schedules with Traffic Management

Description
The City of Seattle Department of Transportation currently has some coordination of traffic lights with ferries arrival on Coleman Dock. It would be useful to expand this to all ferry routes and have this integrated into any routing done in WA-Trans.

Audience
WSDOT, Counties, Cities, Emergency Management, E-911

Function
Public Works, Departments of Transportation, Emergency Management, E-911

Source
Seattle Department of Transportation

Business Need
42

Title
Expansion of Lifelines Statewide

Description
King County Emergency Management has developed a GIS in support of “lifelines”. A lifeline is a combination of critical facilities (hospitals, schools, etc.) connected by routes, which can be repaired quickly (within 24 hours) with local things. The goal is that all parties have the same priorities after an emergency event. They need to know where trains are and ferries are as part of this effort.

Audience
WSDOT, Counties, Cities, Emergency Management, E-911

Function
Emergency Management Organizations, E-911, Counties, Cities, Police, Fire

Source
King County Emergency Management

Business Need
43

Title
Determination of Evacuation Routes

Description
In a major emergency evacuation routes must be identified and communicated. In planning for an emergency potential evacuation routes must be determined. Software must support changing these routes based on type of emergency, location of emergency and condition of the evacuation routes. Freight needs must e included in evacuation route planning - ex. which routes can accommodate heavy trucks?

Audience
WSDOT, Counties, Cities, Emergency Management, E-911

Function
Emergency Management Organizations, E-911, Public Works, Transportation, Police, Fire, Public Communication, Freight

Source
King County Emergency Management; WSDOT Freight Strategy & Policy Office

Business Need
44

Title
Access into a Disaster Area

Description
In a disaster or major emergency it is necessary to bring people and supplies into the disaster zone. For Washington this can include over mountain passes in snow. Planning for such an even includes modeling possible routes for bringing in emergency assistance, National Guard, FEMA and other organizations needed. Freight logistics

need to be included in planning emergency supply lines for moving freight and goods into and out of secured areas. Then in an actual event determination of which routes to use and communication of such routes is necessary. WA-Trans can facilitate determining access into a disaster area.

Audience
WSDOT, Counties, Cities, Emergency Management, E-911

Function
Emergency Management, E-911, Relief Organizations, Military, Transportation Organizations, Counties, Cities, Freight

Source
King County Emergency Management, WSDOT Freight Strategy & Policy Office

Business Need
45

Title
Crossing Safety

Description
Using information about specific characteristics about grade crossings, roadway characteristics, traffic counts, and train operations, WUTC and WSDOT Staff are able to conduct accident prediction and other hazard analysis for resource allocation and safety improvements. The data will also assist field inspectors to review crossings for safety improvements, including signal upgrades, crossing surface needs, and related regulatory duties. Crossing defects can be tracked, and railroad company repair performance can be analyzed.

Audience
State Government, Local Government

Function
Safety Analysis, Inspection Priorities, Resource Allocation, Compliance Actions

Source
Washington Utilities and Transportation Commission

Business Need
46

Title

General Railroad Safety Inspections

Description
Using information about rail line locations, commodities hauled, train counts, and other operational information, inspections involving hazardous materials, track, and operation practices can be targeted, planned and optimized. Accidents and HAZMAT releases can be tracked to identify safety problems.

Audience
State Government, Local Government

Function
Safety Analysis, Inspection Planning, Hazard Reduction

Source
Washington Utilities and Transportation Commission

Business Need
47

Title
Trespass Reduction

Description
Using transportation system information including track location and operations, trespass accidents can be plotted, and areas targeted for engineering, enforcement and education efforts.

Audience
State Government, Local Government

Function
Safety Analysis, Hazard Reduction

Source
Washington Utilities and Transportation Commission

Business Need
48

Title
Accurate centerline and right-of-way line work.

Description
The WUTC issues Certificates of Public Convenience and Necessity. These certificates are a property right. They are described in metes and bounds, and roads may be the boundary used in the legal description. It is very important that the location of the line work is accurate.

Audience
State Government, Local Government

Function
Property Right descriptions of franchise service areas.

Source
Washington Utilities and Transportation Commission Solid Waste Section

Business Need
49

Title
Location of specific addresses (geo-coding).

Description
The WUTC-regulated companies can provide solid waste services within specific geographic areas. The location of a specific address is needed to determine which company has the rights to service at a particular location.

Audience
State Government, Local Government

Function
Consumer affairs, Public affairs, Customer notice, Compliance, Accounting, Auditing, Policy

Source
Washington Utilities and Transportation Commission Solid Waste Section

Business Need
50

Title
Who can provide utility services at a specific location? (Geo-coding)

Description

The WUTC regulates multiple utility and transportation companies. Consumers often inquire about which companies provide services where they live. A geo-coded street layer would allow consumers to get answers to those questions. A variety of utility information could be included. The Tulalip Tribe would specifically like water supply and wastewater information geocoded. The Tulalip Utilities Authority regulates the water supply, treatment and transmission derived from its governmental status as a federally recognized Indian Tribe organized pursuant to Section 16 of the Indian Reorganization Act of 1934, and as provided in Article VI Section I of the Tribes duly adopted Constitution. Consumer knowledge about water and wastewater services is necessary for planned development, whether it be the Tulalip Tribes or a private landowner on fee simple lands. Location of fire hydrants of tribal utility services should be identified for public safety decision makers.

Audience
State Government, Local Government, The Tulalip Tribes

Function
Public

Source
Washington Utilities and Transportation Commission Solid Waste Section, Tulalip Utilities Authority and Tulalip Tribes' Community Development Department

Business Need
51

Title
Street Names

Description
The WUTC issues Certificates of Public Convenience and Necessity. These certificates are a property right. They are described in metes and bounds, and roads may be the boundary used in the legal description. We need street names in the roads layer so we can describe the boundary accurately.

Audience
State Government, Local Government

Function
Property Right descriptions of franchise service areas

Source
Washington Utilities and Transportation Commission Solid Waste Section

Business Need
52

Title
Unimproved or Temporary Roads

Description
The WUTC Pipeline Safety Division is required under RCW 81.88.080 to assist local governments in obtaining hazardous liquid and gas pipeline location information and maps. We are also obligated to develop a GIS that is sufficient to meet the needs of first responders.

Audience
State Government, Local Government

Function
Pipeline access points, Construction inspections, Possible evacuation routes

Source
Washington Utilities and Transportation Commission Pipeline Safety Division

Business Need
53

Title
Navigable Waterways and Port Facilities including freshwater ports

Description
Considerable freight traffic moves throughout Washington's navigable waterways (Columbia and Snake River system, ocean ports in Seattle and Tacoma), thus complementing Washington's efficient multi-modal transportation system (truck, rail, barge). Much of this freight, especially for traffic along the Snake and Columbia River system, is traffic, which would otherwise be shipped via rail or truck when barge access is constrained from lock maintenance, or river draw downs thus adding to an already constrained highway system. WSDOT planners and freight policy analyst could benefit from the analytical capabilities of a GIS coverage of all the state's navigable waterways, locks and port facilities. This would be especially useful identifying shipper costs and highway impacts due to river passage restrictions.

Audience
WSDOT, Strategic Freight Transportation Analysis Project

Function
Transportation Planning, Freight Policy, Strategic Freight Transportation Analysis

Project

Source
WSDOT Freight Strategy & Policy Office, Strategic Freight Transportation Analysis Project Snake and Columbia River System

Business Need
54

Title
Geo-Coded Freight Truck Flows

Description
A statewide freight origin and destination truck survey was conducted in 1993-1994 and again in 2002, at 30 selected sites across the state. Detailed information concerning individual truck-trips, commodities, truck configurations, origins, destinations and specific routes for all highways will be incorporated into a GIS and available for highway planners, modelers, and policy analyst.

Audience
WSDOT, Strategic Freight Transportation Analysis Project, Freight Mobility Strategic Investment Board

Function
Transportation Planning, Freight Policy, Strategic Freight Transportation Analysis Project

Source
WSDOT Freight Strategy & Policy, Strategic Freight Transportation Analysis Project

Business Need
55

Title
Freight Goods and Transportation System Updates

Description
WSDOT must comply with federal (FHWA) requirements under the Highway Performance Monitoring System and state legislation (RCW 47.05.021) and identify Washington's freight and goods network and the usage of this network over time. Truck freight data is captured for state highways (1,450 count locations), county roads (CRAB), and city streets (AWC) and compiled to develop the state level freight planning and forecasting model framework and provide the different tonnage classifications (T1-

T5) for all highways. Highway planners, freight policy analyst, counties, cities and other transportation and economic development interests utilize this information.

Audience
WSDOT, Strategic Freight Transportation Analysis Project, Freight Mobility Strategic Investment Board

Function
Transportation Planning, Freight Policy, Strategic Freight Transportation Analysis Project

Source
WSDOT, Strategic Freight Transportation Analysis Project

Business Need
56

Title
Washington State Transportation Data for the National Map

Description
The USGS National Map Project needs the most efficient way to access data. Currently the data the National Map Project will use will come from local data sources with individual agreements for each. WA-Trans would maintain those agreements and provide one source for the transportation data for the National Map, thus simplifying the process and cost of gathering and maintaining the data significantly.

Audience
All Government, Public

Function
National Map Production, General Public, Businesses, Tourists

Source
US Geological Survey

Business Need
57

Title
Tracking Fisheries Information Related to Road/Water Structure

Description

The IRICC Hydrography and Transportation teams identified a business requirement for tracking fisheries information related to road/water structures. This information relates to fish passage regarding roads structures and stream intersections. This information would be tied to dams, culverts, crossings, etc. Fisheries biologists have not specifically identified what this information would be, but a general understanding of its nature is generally understood at this time. The IRICC Hydrography and Transportation teams discussed which coverage would be better suited to tie this to. The decision involved several components, but the fact that the transportation data would be more accurate provided the best reason to hold this cross-coverage information there.

Audience
US Forest Service, US Department of Interior

Function
Fish management, Hatcheries, Environmental Assessment

Source
Regional Ecosystem Office

Business Need
58

Title
Access to historical versions of WA-Trans

Description
For comparison purposes there is a need to store versions of WA-Trans for each specific time period to facilitate historical modeling, comparisons and analysis.

Audience
Metropolitan Planning Organizations, Regional Transportation Planning Organizations, WSDOT

Function
Transportation Planning, Transportation Data Collection

Source
Puget Sound Regional Council

Business Need
59

Title

Compatibility with Related Transportation Frameworks

Description
WA-Trans must be able to exchange data with Transportation Frameworks from Oregon, Idaho and British Columbia, Canada. It must also be compatible with the GeoSpatial One-Stop Transportation Model.

Audience
WSDOT, FHWA, USFS, USGS

Function
Inter-state Transportation Planning, Data Communication, Transportation Data Collection, Transportation Project Funding

Source
Bureau of Transportation Statistics, Oregon Department of Transportation, Interregional Information Coordinating Council, USGS

Business Need
60

Title
WA-Trans Metadata

Description
Federal Geographic Data Committee Standard for describing data geospatial data. This is data that describes the data content of WA-Trans, including data quality, data sources, entities, attributes, applicable time periods of content, and processing steps.

Audience
All

Function
All

Source
Literature

Business Need
61

Title
Designate Indian Reservation Roads Explicitly

Description
Federal law requires consultation with tribal nations in long range transportation planning. Additionally it can be cost beneficial to coordinate planning, development, construction and maintenance of Indian Reservation Roads (IRR) and other local, county and state roads as they are frequently shared and have similar needs. Using WA-Trans to illustrate that would facilitate the consultation process and coordination efforts.

Audience
WSDOT, County and Local Governments, Metropolitan Planning Organizations, Regional Transportation Planning Organizations, Tribal Nations, BIA

Function
Transportation Planning, Transportation Project Funding, Transportation Project Scoping and Design, Transportation Maintenance, Transportation Operations

Source
EWU TTAP, Makah Transportation Planning, BIA

Business Need
62

Title
Identifying Alternate Sources for Roads Funding

Description
There are a variety of sources of funding for work on roads depending on where they are located. If the roads in WA-Trans were categorized based on what type of funding they were eligible for there may be opportunities for funding that are not currently tapped. These include: State, FHWA, Public Lands Highways, Park Roads and Parkways, IRR, and National Wildlife Refuge System under the Federal Lands Highway Program and United States Department of Interior.

Audience
WSDOT, County and Local Governments, Metropolitan Planning Organizations, Regional Transportation Planning Organizations, Tribal Nations

Function
Transportation Planning, Transportation Project Funding, Transportation Project Scoping and Design, Transportation Maintenance, Transportation Operations

Source
EWU TTAP, Makah Tribe Transportation Planning, BIA, Tulalip Tribes Community

Development Department

Business Need
63

Title
Identification of Potential Partners in Transportation Planning

Description
Various road authorities and other interested parties can assist with planning and funding of roadwork. Many of these parties could be identified easily if road authorities were clearly identified with WA-Trans.

Audience
WSDOT, County and Local Governments, Metropolitan Planning Organizations, Regional Transportation Planning Organizations, Tribal Nations

Function
Transportation Planning, Transportation Project Funding, Transportation Project Scoping and Design, Transportation Maintenance, Transportation Operations

Source
EWU TTAP, Tribal Transportation Planning

Business Need
64

Title
Current and Historic Zoning Maps

Description
Current and historic zoning are mapped to the center of the road. This is used by many county departments for planning purposes.

Audience
County and Local Governments

Function
Planning

Source
Pierce County

Business Need
65

Title
Address Geocoding of Crime Incidents

Description
The Sheriff's department routinely maps crime incidents to monitor changes in crime patterns and estimate the resources needed for particular areas.

Audience
County and Local Governments

Function
Analyze Crime Patterns, Estimation of Resources

Source
Pierce County

Business Need
66

Title
Voter Mapping for the Auditor

Description
The Auditor geocodes voter locations and this information is provided to the candidates. This work is also used for re-districting efforts.

Audience
County and Local Governments

Function
Re-districting, Candidate Research

Source
Pierce County

Business Need
67

Title
County Addressing

Description
The County addressor maintains the centerline and address information for the county in order to provide valid address information to other departments and citizens.

Audience
County and Local Governments

Function
Attribute Maintenance

Source
Pierce County

Business Need
68

Title
Address Lookup

Description
Many county departments utilize the GIS system to view information at an address. The address is geocoded to the road centerline/address file. Once the address is located other data themes and data sets are viewed. Utilized by all county departments.

Audience
County and Local Governments

Function
Locating

Source
Pierce County

Business Need
69

Title
County Atlas

Description
The County road atlas is a digital and paper product that is produced to show the public and private roads in the County. Scale is 1"=2000'.

Audience
County and Local Governments

Function
Cartography

Source
Pierce County

Business Need
70

Title
Traffic Count Locations

Description
Map of the traffic count locations with a link to the data records on those counts. This data set is then analyzed to show changes in traffic volumes versus estimated volumes.

Audience
County and Local Governments

Function
Analysis--Level of service

Source
Pierce County

Business Need
71

Title
Mapping of CRIS Information

Description
The County Road Inventory System (CRIS) is a large database of road characteristics. From this database maps and reports are generated and provided to federal and state agencies. The road centerline file is linked via dynamic segmentation to the CRIS records.

Audience
County and Local Governments

Function
Analysis and Reporting

Source
Pierce County

Business Need
72

Title
Accident Mapping

Description
County road engineers have a database of accident information that is linked and mapped on the road centerline file. This is a countywide database that shows historical records.

Audience
County and Local Governments

Function
Analysis--Determination of dangerous road segments and intersections

Source
Pierce County

Business Need
73

Title
County Transportation Improvement Plan

Description
The TIP shows the estimated road improvements for future years. This document is used for budgeting purposes. The proposed improvement are mapped at a scale of 1"=2000' and are linked to the tabular database as well as symbolized in the map product.

Audience
County and Local Governments

Function

Road Construction

Source
Pierce County

Business Need
74

Title
Right-of-Way Feature Inventory

Description
Inventory of signs, guard rails and drainage features are in a database that can be mapped along with the road. This helps maintenance crews and planners determine project requirements.

Audience
County and Local Governments

Function
System Maintenance

Source
Pierce County

Business Need
75

Title
Pavement Management

Description
Pavement management is a large topic that encompasses the capture of pavement conditions, the rating of pavement failure and prioritizing future road surfacing projects. For all of these efforts the road centerline is utilized and data mapped to the road network to show characteristics for pavement management.

Audience
County and Local Governments

Function
Road Maintenance

Source
Pierce County

Business Need
76

Title
Vegetation Spray Areas

Description
Map showing areas to spay and area not to spray. This information is based on road maintenance records and can be mapped to the centerline file.

Audience
County and Local Governments

Function
Right-of-way Maintenance

Source
Pierce County

Business Need
77

Title
Snow Route Mapping

Description
Snow route maps are developed for each of the road maintenance areas and allows the road shops to view their territory as well as surrounding districts. This data is used to dispatch snow crews and coordinate work across the county.

Audience
County and Local Governments

Function
Road Maintenance

Source
Pierce County

Business Need
78

Title
Non-motorized Transportation Plan

Description
The Non-motorized transportation plan is a guide for bicycle, pedestrian and equestrian travel. Maps display existing and proposed facilities. Maps aid travelers in choosing appropriate travel routes. The County arterial roadway map is used as a base map.

Audience
County and Local Governments

Function
Transportation Planning

Source
Pierce County

Business Need
79

Title
County bridge locations

Description
Map showing the bridge locations in the County. 1"=2000'

Audience
County and Local Governments

Function
Bridge Maintenance and Emergency Route Planning

Source
Pierce County

Business Need
80

Title
Intersection Improvement Maps

Description
At engineering scale (1"=50') map of intersections and improvement needed.

Audience
County and Local Governments

Function
Road Construction

Source
Pierce County

Business Need
81

Title
Emergency Management Event Mapping

Description
Mapping of emergency events that could be a point location at an address, a road segment that is closed, an area that is flooded. The road centerline file is used as a backdrop to plan response and recovery.

Audience
County and Local Governments

Function
Emergency Route Planning

Source
Pierce County

Business Need
82

Title
Geocoding County Data

Description
GIS geocoding function is used to map various data sets such as: businesses, events, business licenses, jurors, crimes, and complaints. The road centerline file with address ranges is utilized as the base map and for the geocoding function.

Audience
County and Local Governments

Function
Locating

Source
Pierce County

Business Need
83

Title
Using road and road feature information in the effort to protect wildlife

Description
Road information can be useful in many ways for wildlife protection including: - Spotted Owl management requires understanding road density issues - miles of road per square mile of land; - Road densities influence deer and elk hunting. The more roads in an area, the more likely it is a hunter will succeed in killing a deer or elk; - Deer, elk, and numerous other animals are killed crossing roads, which affects population dynamics; - Slugs, snails and other small critters have a hard time crossing roads; hence roads can present a barrier to some species; - Fragmentation of habitat is influenced by roads in several ways. One is that the road can fragment habitat for some species. Another is that roads are required to access timber sales which affect habitat for some species like the spotted owl.

Audience
US Forest Service, US Bureau of Land Management, National Parks Service, WA DNR, WA State Parks

Function
Public Land Management

Source
US Forest Service

Business Need
84

Title
Supporting work on fish and related hydrography to roads

Description
Maintenance of fish species involves the use of road data and hydrography data. Here are some examples of how roads data helps this work: - Fish passage for resident and anadramous species is influenced by bridge and culvert design issues. - Fish spawning can be affected by sedimentation or other road related issues; - Poorly designed roadways or crossings can cause sedimentation, which covers nesting gravels with fine silts making them unusable by the fish.

Audience
US Forest Service, US Bureau of Land Management, National Parks Service, WA DNR, WA State Parks, WSDOT, Public Works and Roads Departments

Function
Public Lands Management Road Design, Construction and Maintenance

Source
US Forest Service

Business Need
85

Title
Supporting Tribal Treaty Rights

Description
Hunting and fishing is most commonly accessed by roads. Hunting and fishing are treating rights in many cases. Fish passage and habitat associated with roads can affect treaty rights.

Audience
US Forest Service, US Bureau of Land Management, National Parks Service, WA DNR, WA State Parks, WSDOT, Public Works and Roads Departments, Tribal Nations in Washington State

Function
Tribal Nations, Public Lands Management, Road Design, Construction and Maintenance

Source
US Forest Service

Business Need
86

Title
WA-Trans needs to support network analysis regarding moving forest products.

Description
Network analysis can be used to understand the efficiency of moving forest products around. Timber sometimes is moved long distances and haul routes are sensitive to recreation and other issues.

Audience
US Forest Service, US Bureau of Land Management, WA DNR

Function
Public Lands Management, Private Timber Companies

Source
US Forest Service

Business Need
87

Title
Provide support to law enforcement in public lands management

Description
WA-Trans would support the following business processes: - Search and rescue dispatch and other emergency responses; - Enforcement of Special Forest Product and other permits. Examples are mushroom permits, bear grass collections, etc.

Audience
US Forest Service, US Bureau of Land Management, National Parks Service, WA DNR, WA State Parks

Function
Public Lands Management, Law Enforcement

Source
US Forest Service

Business Need
88

Title
Support in homeland security on public lands

Description
This is a new and emerging area for the Federal Government and may apply to some other levels of government as well. Issues include emergency response on public lands, proximity of roads to pipelines, power lines, hazardous waste sites, toxic spills, bridges, etc.

Audience
US Forest Service, US Bureau of Land Management, National Parks Service, WA DNR, WA State Parks, WSDOT, Public Works and Roads Departments, WSP, Local Law Enforcement, WA EMD, Local PSAPs

Function
Public Lands Management, Road Design, Construction and Maintenance, Emergency Management, Law Enforcement

Source
US Forest Service

Business Need
89

Title
Fire Suppression Facilitation

Description
WA-Trans could assist with the fire suppression activities in the following ways: - Determining and following the quickest route to an arbitrary location where crews needs to be dispatched to on short notice; - Recording location of human caused fire starts along a road; - Determining whether a fire is suspicious by its proximity to a road; - Estimating fire "risk" based upon hazardous fuel loading data plus the probability of ignition, which is highest near roads.

Audience
US Forest Service, US Bureau of Land Management, National Parks Service, WA DNR, WA State Parks

Function
Public Lands Management

Source

US Forest Service

Business Need
90

Title
Facilitation of Public Land Management Engineering Activities

Description
Various public land management organizations have engineering sections that do a variety of work, which could benefit from WA-Trans. These include: - Locating and designing temporary and permanent roads for timber sales, campgrounds, etc.; - Recording locations of bridges, culverts, fords, and other stream crossings; - Recording locations of campground loops; - Locating, recording, and maintenance planning for bike, hike, equestrian, 4-wheel drive, and ATV trails; - Access to telecommunication sites like microwave stations, radio repeater stations, etc.; - Determining the best place to put fire observers and lookouts; - Planning and tracking of maintenance on existing roads, including records for Maintenance Levels and other operational data.

Audience
US Forest Service, US Bureau of Land Management, National Parks Service, WA DNR, WA State Parks

Function
Public Lands Management

Source
US Forest Service

Business Need
91

Title
Facilitation of Public Lands Management Development and Maintenance of Recreation

Description
Public lands management organizations provide recreational opportunities to the public. The following work can be facilitated by WA-Trans: - Recreation Opportunity Spectrum (ROS) planning for different types of recreational uses based on proximity to roads. Examples are "Roaded Natural", "Semiprimitive Recreation", and Roadless" areas; - Trail maintenance planning and implementation; - Planning and design for new recreation facilities like campgrounds, picnic areas, interpretive sites, viewpoints, etc.; - Scenery and viewshed analysis; - Maps for hunters, hikers, and other recreationists; - Horse, ATV and off-road vehicle uses.

Audience
US Forest Service, US Bureau of Land Management, National Parks Service, WA DNR, WA State Parks

Function
Public Lands Management

Source
US Forest Service

Business Need
92

Title
Phase II E-911 Cell Phone X,Y Coordinate Mapping

Description
For maximum benefit to the local E-911 call centers i.e., Public Safety Answering Points - PSAP's, the implementation of the FCC's Phase II Wireless regulations will require automatic GIS mapping capabilities within these centers in order to map the actual cell phone locational x,y coordinates that are going to be generated by these calls. This requires that WA-Trans support: 1 address geocoding, 2 linkage of x,y coordinates to other nearby GIS features (ex. road address segments, dispatch units, beat units, etc.) 3 the ability to geocode to digital ortho-photography for rural and wilderness related cell phone calls.

Audience
Washington State Patrol, WA Dept. of Military (EMD) Emergency Operations Center, Local PSAPs, local law enforcement, WSDOT, NIMA

Function
Emergency Management, Law Enforcement, Fire Response, Homeland Security

Source
Washington State Department of Military (EMD), Spokane County Fire Districts

Business Need
93

Title
AVL X,Y Coordinate Mapping

Description
AVL (Automatic Vehicle Location) data, provided by vehicles equipped with AVL technology can be combined with WA-Trans data to provide support in the following areas: fleet management - determining the most efficient routes and vehicle use, determine actual delivery costs, check employee on the road compliance; locating vehicles in an emergency - finding the X,Y coordinate, determining an addressing and dispatching emergency vehicles to the site using shortest path. This requires WA-Trans to have street centerline, address geocoding, and a dispatch network. This is also useful for fire response in dispatching fire trucks. Homeland security can use this technology to track vehicles that might contain explosive or toxic materials to make sure they are being used properly.

Audience
Local Public Works Depts., Ecology, Health Departments, Washington State Patrol, Emergency Management Division, WA Emergency Operations Center, Local PSAPs, Local Law enforcement, WSDOT, NIMA

Function
Routing, Delivery Service, Permit Enforcement, Permit Issuance, Trash Collection, Emergency Management Vehicle Tracking, Law Enforcement Vehicle Tracking, Freight Management, & more!

Source
WA State Dept. of Military Emergency Management Division, Spokane County Fire Districts

Business Need
94

Title
Development and Maintenance of Street Names

Description
The Tulalip Tribes Community Development Department needs to consolidate street names and provide street names to unnamed roads. Several streets within the exterior boundaries of the Tulalip Indian Reservation have more than one name. They have a numeric name that provides ease for navigation. Some also have a second name that is a historic name. Others have no name but have residential addresses designating a nearby street. For navigating during emergency services, street names are crucial.

Audience
The Tulalip Tribes, Emergency Management

Function

All Tulalip Tribes Public Service Organizations, Visitors, Emergency Management

Source
Tulalip Tribes Community Development

Business Need
95

Title
CVISN, Weight-in Motion, and Weight Station Information

Description
Information about weight station locations and use, weight-in-motion locations and use and other truck information collected by the Commercial Vehicle Information System and Network (CVISN, a WSDOT application) and geo-coded would be useful in identifying patterns in freight flows.

Audience
WSDOT, WSP, Strategic Freight Transportation Analysis Project, Washington State Transportation Center at U 0f W (TRAC), MPOs & RTPOs

Function
Freight, State Patrol, Transportation Planning

Source
WSDOT Freight Strategy & Policy Office

Business Need
96

Title
Identifying Freight Chokepoints

Description
Freight chokepoints can be defined as areas where trucks routinely encounter delay due to traffic or road conditions (excluding border crossing, which are handled separately). Delays in travel time result in substantial cost increases for freight transport, but it is impossible to focus on correcting bottlenecks and chokepoints until there is data showing where they are and how severe they are.

Audience
WSDOT, Strategic Freight Transportation Analysis Project, Washington State Transportation Center at U 0f W (TRAC), MPOs & RTPO's

Function
Freight, Transportation Planning

Source
WSDOT Freight Strategy & Policy Office

Business Need
97

Title
International Border Crossing Delay for Commercial Vehicles

Description
International border crossing delay is caused by several factors, such as truck volumes, checkpoint staffing and hours of operation, volume of other type of vehicles, time needed for clearing customs, and increased security measures. Knowing average wait and processing times, truck volumes, border crossing and alternative route information can benefit both short and long term freight planning.

Audience
WSDOT, Strategic Freight Transportation Analysis Project, MPOs & RTPOs

Function
Freight

Source
USDOT/Homeland Security, B.C. Ministry of Transportation, International Mobility and Transportation Coalition (IMTC), Eastern Border Transportation Council via WSDOT Freight Strategy and Policy Office

Business Need
98

Title
Freight Access and Freight Exchange at Marine Deep-water Ports

Description
The ports of Tacoma and Seattle combined form one of the largest cargo container terminal operations on North America's west coast. Access to and from the Washington ports is through heavily congested Puget Sound urban areas. Information is needed about port import/export volumes; commodity origin/destination, content, and value; terminal logistics and hours of operation; and truck/rail access routing. This information

is extremely useful in transportation planning for freight mobility on roadways, efficient intermodal transfers, and anticipating future growth needs.

Audience
WSDOT, Strategic Freight Transportation Analysis Project

Function
Ports, Freight, Coast Guard, Railroads

Source
WSDOT Freight Strategy & Policy Office

Business Need
99

Title
Location of Freight Hubs

Description
Freight traffic is often concentrated at points of origin, destination, or transfer, and as a consequence, state and local roads often become heavily traveled defacto freight routes. Planning for adequate freight transportation capacity could be greatly enhanced by location of information for major industry manufacturing and distribution centers, agricultural product processing and transfer sites, intermodal transfer stations (including air cargo hubs) and commercial truck stops in relationships to roads, rails and other transportation features.

Audience
WSDOT, Strategic Freight Transportation Analysis Project, MPOs & RTPOs

Function
Freight, Transportation Planning, Railroads, Airports

Source
Community Trade & Economic Development via WSDOT Freight Strategy and Policy Office

Business Need
100

Title
Freight Trip Planner

Description
Using the WSDOT Public Transportation Office “Trip Planner” effort as a model, a freight trip planner could be developed. The purpose of this tool would be to enable truckers, shippers, haulers, delivery drivers, etc. to access information about freight routing, weight restricted areas, avoiding congestion, location of services, intermodal transfer sites, weigh stations, etc. A link to the Motor Carrier Services website would provide additional guidance on truck permits and licenses.

Audience
WSDOT, Freight Interests

Function
Private industry (business, manufacturing, freight transfer, trucking), Ports

Source
WSDOT, Washington State Patrol

Business Need
101

Title
Coordination With Federal Agencies ad States

Description
The Intergovernmental Resource Information Coordinating Council (IRICC) has established a set of data standards and protocols for coordinating transportation information across agencies. These standards have been adopted by the State and Federal agencies as an exchange standard in order to meet their individual requirements for neighboring transportation information. As a business need it is critical that any new State standards meet these interagency requirements in order to ensure the coordination of interagency transportation information.

Audience
All federal, state and county partners coordinating on transportation information.

Function
Coordination of transportation information across State and Federal systems.

Source
IRICC data standard. www.reo.gov

Data Needs

Business needs were expressed which involved the use of this data in relationship to the transportation network across the State. These data items may not, in some cases should not, be part of WA-Trans. However WA-Trans may facilitate analysis by working with this data to assist in meeting specific business needs.

Data Category – This field is a high level category of various data elements that allows for development of "themes" of data, which can be goecoded into different layers in a GIS.

Specific Data – Individual data elements, which relate to the category that stakeholders want to see in relation to the transportation network. No detail is provided about these elements at this point.

Source of Need – The original organization requesting this data with the transportation data.

Business Function – The business function that may use this data or may contribute this data.

Framework Theme – Where a framework theme in Washington State has the data within its scope it is identified here.

Data Category	***Specific Data***	***Source of Need***	***Business Function***	***Framework Theme***
Utilities	Gas line locations	WSDOT Project Engineers, WSDOT ITS (TRAC), WSDOT State Design Office, BOC	Transportation Construction	None
Utilities	Phone power lines	WSDOT Project Engineers, WSDOT ITS (TRAC), WSDOT State Design Office, BOC	Transportation Construction	None
Utilities	Wireless transmission	WSDOT Project Engineers, WSDOT ITS (TRAC),	Transportation Construction	None

Data Category	***Specific Data***	***Source of Need***	***Business Function***	***Framework Theme***
		WSDOT State Design Office		
Utilities	Date and location about digging	WSDOT Olympic Region H&LP Engineer	Transportation Construction and Maintenance	None
Parcel Data	Ownership along roadways, railways, ferry terminals	WSDOT Project Engineers, WSDOT Rail Office, WSDOT Bridge Preservation Office	Transportation Construction, Maintenance and Operations, Emergency Management	Cadastral?
Parcel Data	Homes and businesses along projects and by ferry terminals and Geocoding to census geography	WSDOT Urban Corridors, WSF Terminal Engineering, BOC	Transportation Construction, Transportation Planning, Counties and Cities, Public	Cadastral?
Land Use	Zoning data including landmarks such as cemeteries, parks, military land	WSDOT Project Engineers, WSDOT Environmental Affairs Office, WSF Terminal Engineering, WSDOT Planning Office, BOC	Transportation Planning, Environmental Assessment, Transportation Construction, Commute Trip Reduction, Transit	None
Land Use	Urban Growth Boundaries	WSDOT Project Engineers, WSDOT Environmental Affairs Office, WSF Terminal Engineering, WSDOT Planning	Transportation Planning, Environmental Assessment, Commute Trip Reduction, Transit, Counties and Cities	None

Data Category	***Specific Data***	***Source of Need***	***Business Function***	***Framework Theme***
		Office, BOC		
Land Use	Boundaries of "critical areas" such as burial grounds on tribal land	WSDOT Olympic Region Design, WSDOT Environmental Affairs Office	Transportation Planning, Environmental Assessment, Transportation Construction, Counties and Cities	None
Land Use	Historic sites (historic districts, bridges, and public lands	WSDOT Environmental Affairs Office	Transportation Planning, Environmental Assessment, Transportation Construction, Counties and Cities	None
Land Use	Community centers, school district locations and boundaries, weigh stations along roadways	WSDOT Program Management, WSDOT Design Office, BOC	Transportation Planning, Transportation Construction, Transit, Commute Trip Reduction, Counties and Cities	None
Land Use	Shore Master Permits along ferry terminals	WSF Terminal Engineering	Transportation Planning and Construction, Environmental Assessment	None
Land Use	Comprehensive along Ferry terminals	WSF Terminal Engineering	Transportation Planning and Construction, Environmental Assessment	None
Land Use	Structure centroids or footprints assist BOC with ability to incorporate GS technology into field	BOC	Census activities	None

Data Category	***Specific Data***	***Source of Need***	***Business Function***	***Framework Theme***
	enumeration activities.			
Environmental	Location of well headers	WSDOT Olympic Region Design	Transportation Construction, Environmental Assessment	None
Environmental	Delineated wetlands location and buffer and environmental classification in project area or along roadway	WSDOT Olympic Region Design, WSDOT Rail Office, WSDOT Urban Corridors, WSDOT Maintenance and Operations	Transportation Construction, Environmental Assessment, Natural Resource Management	Hydrography
Environmental	Creek, stream, and river location and buffer and environmental classification in project area or along roadway, used as boundaries by BOC	WSDOT Rail Office, WSDOT Urban Corridors, WSDOT Olympic Region Design, WSDOT Maintenance and Operations, BOC	Transportation Construction, Environmental Assessment, Natural Resource Management	Hydrography
Environmental	Storm water treatment facilities and conveyances	WSDOT Olympic Region Design, WSDOT Environmental Affairs Office	Transportation Construction, Environmental Assessment, private business	None
Environmental	Drainage onto and off of project area	WSDOT Environmental Affairs Office	Transportation Construction, Environmental Assessment, Natural Resource Management	Hydrography
Environmental	100 year flow of water crossings	WSDOT Environmental	Transportation Construction,	Hydrography (potential/future)

Data Category	***Specific Data***	***Source of Need***	***Business Function***	***Framework Theme***
	on project areas	Affairs Office, WSDOT State Design Office	Environmental Assessment	
Environmental	Species and natural resources around a ferry terminal	WSF Terminal Engineering	Transportation Construction, Environmental Assessment, Natural Resource Management	None
Environmental	Topographic and Bathymetric Data around ferry terminals	WSF Terminal Engineering	Transportation Construction, Natural Resource Management	Orthophoto
Economic Data	Business and Industry Locations along routes	WSDOT Planning Office, WSDOT Transportation Demand Management Office	Transportation Planning, Transit, Commute Trip Reduction, Transportation Construction, Environmental Assessment	None
Economic Data, Parcel Data, Land Use Data	Locations of social service providers, employment centers, medical care, day care providers, individuals using social services and transit routes	WSDOT Public Transportation Office	Transit, County, City, and State Social Service Providers	Cadastral? (Partially)
Transportation Data	Road signal locations	WSDOT Olympic Region H&LP Engineer	Transportation Planning, Transportation Construction, Transit, Route Planners, Emergency Management,	None

Data Category	***Specific Data***	***Source of Need***	***Business Function***	***Framework Theme***
			Counties and Cities	
Transportation Data	Structures involved in collisions	WSDOT Olympic Region H&LP Engineer, Seattle DOT	Transportation Planning, Transportation Construction, County and Cities	None
Transportation Data	Collision locations	WSDOT Planning Office, WSDOT Transportation Data Office, Seattle DOT	Transportation Planning, County and Cities	None
Transportation Data	Various structures on county and cities roads (tunnels, bridges)	WSDOT Bridge Preservation Office, Seattle DOT	Counties, Cities, Emergency Management, Transportation Planning, Freight	None
Transportation Data	Traffic data for all modes including walking, bus, rails, water based travel, bikes, roads leaving state routes to arterials	WSDOT Urban Corridors, WSF Terminal Engineering, WSDOT Transportation Demand Management Office, Seattle DOT	Transportation Planning, Transportation Construction, Cities and Counties	None
Transportation Data	Pedestrian accident location data including: route location, road condition, traffic volume, speed, marked and unmarked cross walks, driveway locations, types of injury,	WSDOT Highways and Local Programs	Transportation Planning, Cities and Counties, Transportation Maintenance and Operations	None

Data Category	***Specific Data***	***Source of Need***	***Business Function***	***Framework Theme***
	medians, left turn lanes			
Transportation Data	Railroad crossing data including: safety rating, status of rail line at crossing (active, inactive) rate of train crossing, time of day of crossings, average daily traffic at crossings, ownership of lines	WSDOT Rail Office, WSDOT Bridge Office, Seattle DOT	Transportation Planning, Transportation Maintenance and Operations, Freight, Counties, Cities, Emergency Management	None
Transportation Data	Road locations	Pierce County, WUTC	All	None
Transportation Data	Road ownership and management information (sometimes called road authority) including owner level, owner name, manager level, manager name	IRICC Core Data Standards (IRICC Roads Committee)	Transportation Maintenance and Operations, Environmental Assessment and Modeling, Freight, Federal Land Management	None
Transportation Data	Road Functional Classification, Functional Type	IRICC Core Data Standards (IRICC Roads Committee)	DOTs, county and local road management at all levels, Land Management at all levels	None
Transportation Data	Road quality and use information including	IRICC Core Data Standards (IRICC Roads	DOT's, county and local road management at all levels,	None

Data Category	***Specific Data***	***Source of Need***	***Business Function***	***Framework Theme***
	Road Status, Road Surface Type	Committee)	land management organizations at all levels	
Transportation Data	Address range on road segments	Pierce County, WUTC, Seattle Public Utilities	Environmental Assessment, County and local governments, Emergency management	None
Transportation Data	Routing System	Pierce County, City of Tacoma, Seattle Public Utilities	E-911, Local and County Governments	None
Transportation Data	CRIS characteristics data on roads that includes (type, name, width, functional class, speed limit, etc.)	Pierce County	Transportation Planning, Transportation Analysis, MPO, County and Local Public Works	None
Transportation Data	Transportation Plans including the STIP, various TIPs and Tribal TIPs	EWU TTAP, Makah Transportation Planning	Transportation Planning, Transportation Funding	None
Transportation Data	Designators for roads from the FHLP including Indian Reservation Roads	EWU TTAP, Makah Transportation Planning	Transportation Planning, Transportation Funding, Transportation Maintenance and Operations	None
Census	Population of communities through which state highways pass.	WSDOT State Design Office,	Transportation Planning, Transportation Construction	None

WA-Trans Project Risk Assessment
As of January 8, 2003

Executive Summary

A risk assessment is a key component of any set of project management deliverables for a project. It is particularly critical for large and potentially complex projects. The Washington Transportation Framework for GIS Project (WA-Trans) is particularly complex for a variety of reasons. Those include the cross-jurisdictional, cross-business functional nature of the project and all of the political, cultural and related risks. Additionally, at this time, the project is largely unfunded. A project manager is the only funded element. Volunteers from various organizations statewide are handling the rest. That adds some risks in and of itself. Additionally there are technical issues to be resolved. Several other states and the federal government are working on this and a major mitigation strategy is to examine the lessons they have learned.

In regard to this risk assessment, risks were evaluated in various categories. Risks were defined in terms of risk conditions and risk consequences. A single risk is a combination of a condition and consequence. The same risk condition can have several possible consequences. The risk exposure was evaluated in terms of the probability of the risk occurring and the impact to the project should that risk occur. Probability was quantified as follows: 1 – Impossible, 2 – Improbably, 3 – Probable, 4 – Frequent. Impact was evaluated in this way: 1 - Negligible, 2 – Marginal, 3 – Critical, 4 – Catastrophic. These values were multiplied and the combination determined the risk exposure.

Risk Categories and High Exposure Risks

A listing of the highest risks by categories follows. Summaries of possible mitigation strategies are outlined.

Funding and Governmental Authorization

- The project doesn't get funding so the project fails to make progress on deliverables. Mitigation strategies include pursuing grant opportunities and all related efforts including establishing a grant strike team, setting up schedules and project plans for various funding situations and resource availabilities, pursuing the use of paid university students to perform the actual technical work to save costs, selling the project to the legislature as a cost saving effort based on evaluation of money already being spent to pursue similar individual data gathering efforts.
- Lack of education or knowledge regarding framework concept or GIS leads to an unwillingness or inability for various partners to participate and business needs are not identified. Mitigation strategies include developing a communication plan and presentation materials that will educate participants about WA-Trans and continuing to document different business needs so the project maintains information about what is needed by participants.
- Funding and data agreements and architecture don't include maintenance costs and plans so framework data and data agreements become obsolete and there is no responsible entity for maintenance identified. Mitigation strategies include making maintenance a requirement of the data sharing agreement, including maintenance in any funding requests, including maintenance in pilot projects so costs and impacts can be accurately tracked, communicated and evaluated.

Limited Partnership Participation in Development and Maintenance of Project

- New partners joining the project after project plan is in place lead to business drivers and priorities changing. Mitigation strategies include gathering business needs for new partners and determining the commonalities with those already gathered and developing change management processes for handling scope changes once business requirements and prioritization is complete.
- Conflicts exist with security levels needed to meet identified business needs so some partners refuse to provide data. Mitigation strategies include gathering security needs as part of the requirements process and allowing some level of security of some data where needed, provide a "public domain" version and other versions, attribution or layers for some specific users.

Private-government Partnership Issues

- Conflicts regarding public disclosure laws and the need to share data and the need for using data some don't want shared lead to opportunities for getting data from private organizations (utilities, private forest land owners) are complex or impossible. Mitigation strategies include including private data providers in the planning process to assist with developing strategies for handling data and data sharing requests.

Network Infrastructure and Technology Shortcomings

- Bandwidth doesn't support data exchange so data transfer if viewed as too slow by framework users. Mitigation strategies include pilot testing of the largest most complex data sets to troubleshoot packet size and number of packets transferred or contracting out hosting of WA-Trans with minimum specifications for speed and bandwidth.

Compatibility of Data Standards, boundaries and Deliverable Timetables

- Development of the base map with attribution is too slow for some business needs identified so funding and resource opportunities are lost. Mitigation strategies include attaching funding requirements to meet urgent needs, using a pilot to show value of providing data to WA-Trans, consider a scaled down version for the first release with a release schedule for additional attribution.

Facilitating Development of the Most Useful Applications

- The project is unable to schedule key resources at the needed time so the project schedule is not followed. Mitigation strategies include communicating the cost of changes to partners on a regular basis, having alternatives planned for each resource and using change management processes for dealing with resources losses.
- The business needs identified by funding organizations are too complex for times available to develop the first release so funding opportunities are lost. Mitigation strategies include providing and option for "purchase" (RFQ) of data for short-term use, performing continuous risk management including assessing the risks of each requirement to meeting a business needs, adding a contingency factor in the budget and schedule for risk assessed on complex business needs or providing a release of WA-Trans that is a starting point for them and they can adapt and refine it to meet their specific needs.

Future Plans and Uses for Risk Assessment

This risk assessment is a continually changing document as new risks are discovered, others are successfully mitigated or the opportunity for them to occur passes without difficulty. Additionally the WA-Trans Steering Committee and Partners Group are evaluating this document. These groups have to provide more detailed input to the document to make sure it represents risks as seen across the project. That evaluation is currently underway.

WA-Trans Project Risk Assessment
As of January 8, 2003

Introduction

A risk assessment is a key component of a risk management plan. A well-done risk assessment will provide a timeline for watching for specific risks and mitigation strategies that can be implemented when a particular risk is "triggered". The risk assessment for WA-Trans was begun very early in the project and some of the mitigation strategies are already in place and working as anticipated. Because of the continuing nature of the risk management throughout the lifecycle of a project all risks that seem possible at any point of the project have been identified. However new risks will appear and this document should be updates at a minimum for each phase, and very likely more often.

Risks are defined within specific categories to facilitate grouping and organization and to illustrate linkages between risks and mitigations. This document defines risks as a combination of "*risk conditions*" and "*risk consequences*". A particular risk condition may have multiple risk consequences. That is illustrated though out this risk assessment. Sometimes a risk consequence becomes a risk condition for other consequences. They interdependent nature of risks means there may be multiple similar risks documented. Additionally the one mitigation strategy may handle several different but related risks. Each risk category is defined and followed by the risks that fall under that category.

For each risk combination an impact is defined. *Impact* is defined as the "loss or effect on the project is the risk occurs". *Probability* is defined as "the likelihood the risk will occur". The *timeframe* is defined as "the period when action is required in order to mitigate the risk" Timeframe is referred to as "Time" in this risk assessment. *Risk exposure* (RE) is defined as an attribute of risk that is derived from impact and probability using the following relationship: "RE = Prob(UO) * Loss(UO) where Prob(UO) is the probability of an unsatisfactory outcome (UO) or risk, and Loss(UO) is the loss to the parties affected if the outcome is unsatisfactory (i.e., the risk occurs)." In this case probability was assigned based on whether it had already occurred or appeared to be likely to occur. These are subjective judgments, which will benefit from input for all partners.

The following table illustrates how the relationship between impact, probability and risk exposure were evaluated for this risk assessment both qualitatively and quantitatively:

	Probability			
Impact	**Frequent (4)**	**Probable (3)**	**Improbable (2)**	**Impossible (1)**
Catastrophic (4)	High (16)	High (16)	Moderate (8)	None (4)
Critical (3)	High (12)	Moderate (9)	Moderate (6)	None (3)
Marginal (2)	Moderate (8)	Moderate (6)	Low (4)	None (2)
Negligible (1)	Moderate (4)	Low (3)	Low (2)	None (1)

[i]

This document can be used to assess risks and provide guidance to recognize approaching risks and plans made early in the project which allows for the contingencies and project structures to be implemented which support specific mitigation strategies through out the project and the use of continuous risk management as a major project management tool. The charter, work plan, budget and communication plan should all be coordinated with the risk assessment in mind to support the use of continuous risk management.

Because managing risks involves tracking the risks and mitigation strategies this document uses **bold letters** when a mitigation strategy is underway and comments following in *italics* to explain what the status of the mitigation strategy is. Periodically the steering committee will change a risk probability and or impact based upon the mitigation strategy status.

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WA-Trans Project Risk Assessment
As of January 8, 2002

I. **Risk Category:** ***Funding and Governmental Authorization*** - Funding is key for the successful completion and maintenance of WA-Trans. To get funding and related resources authorization of the project must be gained from varying levels of government.

Risk #	*Risk Condition*	*Risk Consequence*		*Impact*	*Probability*	*Exposure*	*Time*	*Mitigation Strategy*
A.	The project doesn't get funding	1.	The project fails to make progress on deliverables.	4	4	High	P1, P2, P3	• **Pursue grant opportunities where possible** (I-A1) (*A grant request was made to FEMA and FHWA, Grant Strike team being formed)*, • Get administrative help with grant writing skills (I-A1), • **Set up schedule with associated time constraints and risk for: an all volunteer project, a limited budget project, higher budget project based on target completion date** (I-A1), (*schedule established for Phase I assumes no budget*), • Pursue use of paid university students to do much of work at lower costs (I-A1), • Find a secondary facilitator (I-A2), • Leverage existing project funding by identifying areas where WA-Trans will save and use potential savings to pay for WA-Trans (I-A), • Sell the project directly to the legislature as a cross-agency, statewide project (I-A), • Reduce the project expectations and scope to lower the cost (I-A), • **Document process well and be ready for turnover** (I-A2) (*Project continually documented*), • **Develop a "Grant Strike Team" to research grant opportunities, write grant proposals and follow through the grant process** (I-A), (*Subcommittee being formed, lead by Lisa Stuebing*), • Develop methods for getting vertical use of data, find opportunities for state agencies to use local data, where currently they aren't, pilot those opportunities and market the value of local data, to create a demand which will facilitate getting funding (I-A).
		2.	WSDOT pulls project resources.	4	2	Mod	P2, P3	
B.	WSDOT decides not to support the effort	1.	Project Manager is pulled from the project.	4	2	Mod	P2, P3	• Find a secondary facilitator (I-B1), • **Document process well and be ready for turnover** (I-B1), (*Project continually documented*),
		2.	There is no central focal point for the project.	3	1	Low	P2, P3	

Legend

Impact Rating: *1* – Negligible, *2* – Marginal, *3* – Critical, *4* – Catastrophic
Probability Rating: *1* – Impossible, *2* – Improbable, *3* – Probable, *4* – Frequent
Risk Exposure Level: None, Moderate (Mod), High
Time: *P1* – Phase 1, *P2* – Phase 2, *P3* – Phase 3, *P-P3* – Post Phase 3

Bold Mitigation Strategy - Progress
Italicized Comments – Status of Mitigation

Risk #	*Risk Condition*	*Risk Consequence*		*Impact*	*Probability*	*Exposure*	*Time*	*Mitigation Strategy*
		3.	The project is unable to meet internal WSDOT business needs.	3	2	Mod	P2, P3	• Determine who has most benefit-cost remaining and ask them to lead the effort (I-B1, I-B2), • **Continuously reevaluate needs and commitment while still participating and working on the project** (I-B)(*Steering Committee and Partners continually provide input*), • Document cost for WSDOT of not participating and cost for not leading effort (I-B).
C.	Lack of education or knowledge regarding framework concept or GIS	1.	Unwillingness or inability to participate	4	4	High	P1, P2, P3	• **Develop a communication plan and presentation materials that will educate participants about WA-Trans** (I-C1, I-C3), (*Presentation materials developed*), • **Develop and continue to refine estimates of scope, cost and schedule with assumptions documented and communicate those whenever possible** (I-C2), (*A couple of estimates have been developed based on a couple of different assumptions*), • **Continue to document different business needs so the project maintains information about what is needed by participants** (I-C3), (*Business needs are still being documented but in a less proactive manner*), • **Use meetings to document business needs as opportunities to educate potential participants about the WA-Trans** (I-C), (*business documentation meetings have provided a key opportunity for education and successfully soliciting participation*), • Develop change management process for handing scope changes once business requirements and prioritization is complete (I-C3), • Use alternative sources for data including ortho-photos to compensate for missing data (I-C5).
		2.	Unrealistic expectations developed regarding project deliverables	3	3	Mod	P2, P3	
		3.	Business needs not identified	4	4	High	P1, P2, P3	
		4.	Framework not used	4	2	Mod	P-P3	
		5.	Data needed for a jurisdiction not made available	4	2	Mod	P3	
D.	Large upfront investment is required in infrastructure.	1.	Requires a long time to "pay off".	4	3	High	P2, P3	• Develop cost-benefit analysis, which show payoff rate and focus on business needs that have the highest early payoff first (I-D1). • Plan for a slow paced implementation with lower expectations meeting a set of business needs which required the lowest cost implementation, building the "budget model"(I-D2).

Legend

Impact Rating: *1* – Negligible, *2* – Marginal, *3* – Critical, *4* – Catastrophic
Probability Rating: *1* – Impossible, *2* – Improbable, *3* – Probable, *4* – Frequent
Risk Exposure Level: None, Moderate (Mod), High
Time: *P1* – Phase 1, *P2* – Phase 2, *P3* – Phase 3, *P-P3* – Post Phase 3

Bold Mitigation Strategy - Progress
Italicized Comments – Status of Mitigation

WA-Trans Project Risk Assessment
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Risk #	*Risk Condition*	*Risk Consequence*		*Impact*	*Probability*	*Exposure*	*Time*	*Mitigation Strategy*
		2.	With current funding realities funding is very difficult to get.	3	4	High	P1, P2, P3	implementation, building the "budget model"(I-D2), • Develop a pilot as a "proof of concept" which will sell the concept to the largest group of potential users with the most money to spend on supporting a wider implementation (I-D).
E.	Funding and data agreements and architecture don't include maintenance costs and plans.	1.	Framework data and data agreements becomes obsolete.	4	4	High	P-P3	• Making maintenance a requirement of the data sharing agreement (I-E1, I-E2, I-E3), • **Include maintenance costs in any funding requests** (I-E), (*Both decision package request and grant requests have explicitly stated maintenance costs*), • Include maintenance as part of any pilot efforts so costs and impacts can be accurately tracked, communicated and evaluated (I-E), • Include a regular QA cycle as part of WA-Trans maintenance to check for quality of data and maintenance over time (I-E), • Update WA-Trans for orthophotos and other sources where maintenance can't be relied upon (I-E), • Begin implementation of Ken Dueker's proposal for long-term maintenance of WA-Trans.[ii]
		2.	There is no responsible entity for maintenance identified.	4	4	High	P3	
		3.	Framework is not used.	4	2	Mod	P3	
		4.	Some data will not work with the framework over time.	4	2	Mod	P-P3	
F.	Inadequate cooperation between jurisdictional and political boundaries	1.	Data is missing	4	3	High	P3	• **Use the steering committee to minimize the cooperation complexity and coordinate the effort** (I-F), (*Steering Committee formed and active and making decisions*), • Develop software algorithms to facilitate data integration (I-F3), • Develop agreements and funding for supporting long term integration (I-F) • Provide option for "purchase" (RFQ) of data for short-term use (I-F1), • Use alternative sources for data including orthophotos to compensate for missing data (I-F1), • **Show examples of where concerns cross boundaries, natural or man made disasters, freight mobility issues, and various other reasons why multiple jurisdictions should become involved and cooperate** (I-F), (*Many business needs focus on these things).*
		2.	The framework isn't used	4	2	Mod	P-P3	
		3.	Data won't "connect"	3	2	Mod	P-P3	

Legend

Impact Rating: *1* – Negligible, *2* – Marginal, *3* – Critical, *4* – Catastrophic
Probability Rating: *1* – Impossible, *2* – Improbable, *3* – Probable, *4* – Frequent
Risk Exposure Level: None, Moderate (Mod), High
Time: *P1* – Phase 1, *P2* – Phase 2, *P3* – Phase 3, *P-P3* – Post Phase 3

Bold Mitigation Strategy - Progress
Italicized Comments – Status of Mitigation

II. **Risk Category:** ***Limited Partnership Participation in Development and Maintenance of Project*** **–**Broad partnership participation and buy-in is the key to creating a usable product and having support and data for maintenance.

Risk #	*Risk Condition*	*Risk Consequence*		*Impact*	*Probability*	*Exposure*	*Time*	*Mitigation Strategy*
A.	The project doesn't get key partner executive understanding, support, sponsorship	1.	Partners don't participate.	4	3	High	P1	• **Communication appeals to executives** (II-A), (*Set up a meeting with WSDOT Chief of Staff*), • Cost/Benefit analysis showing value of participation targeted at different government levels, different business functions (II-A), • **Create summaries of business needs targeted at different government levels, different business functions** (II-A), (*There are presentations targeted at different levels and groups, and some summaries*) • Complete pilot to demonstrate usefulness (II-A), • Use pilot to show cost and resources needed specifically (II-A), • **Continue to refine a broad-based business needs assessment including new partners and user groups as discovered** (II-A), (*Business needs definition is an ongoing process, but is now being handled in a less proactive manner*), • Find alternative data sources such as purchase or use from other groups or developing from ortho-photos. Include cost of such measures in plans and budgets (II-A 5).
		2.	Partners don't provide resources.	3	3	Mod	P1, P2, P3	
		3.	Partner organization's business needs are not identified.	3	3	Mod	P1	
		4.	Partners don't plan and identify funding opportunities and financial incentives.	4	3	High	P1, P2, P3	
		5.	Partners' data is not available to the framework.	3	3	Mod	P2, P3	
B.	Funding and data agreements and architecture don't include maintenance costs and plans.	1.	Framework data and data agreements becomes obsolete.	4	4	High	P-P3	• Making maintenance a requirement of the data sharing agreement (II-B1, II-B2, II-B3), • **Include maintenance costs in any funding requests** (II-B),), (*Both decision package request and grant requests have explicitly stated maintenance costs*), • Include maintenance as part of any pilot efforts so costs and impacts can be accurately tracked, communicated and evaluated
		2.	There is no responsible entity for maintenance identified.	4	4	High	P3	
		3.	Framework is not used.	4	2	Mod	P3	

Legend

Impact Rating: *1* – Negligible, *2* – Marginal, *3* – Critical, *4* – Catastrophic
Probability Rating: *1* – Impossible, *2* – Improbable, *3* – Probable, *4* – Frequent
Risk Exposure Level: None, Moderate (Mod), High
Time: *P1* – Phase 1, *P2* – Phase 2, *P3* – Phase 3, *P-P3* – Post Phase 3

Bold Mitigation Strategy - Progress
Italicized Comments – Status of Mitigation

WA-Trans Project Risk Assessment
As of January 8, 2002

Risk #	*Risk Condition*	*Risk Consequence*		*Impact*	*Probability*	*Exposure*	*Time*	*Mitigation Strategy*
		4.	Some data will not work with the framework over time.	4	2	Mod	P-P3	impacts can be accurately tracked, communicated and evaluated (II-B), • Include a regular QA cycle as part of WA-Trans maintenance to check for quality of data and maintenance over time (II-B), • Update WA-Trans for orthophotos and other sources where maintenance can't be relied upon (II-B), • Begin implementation of Ken Dueker's proposal for long-term maintenance of WA-Trans.[iii] (II-B)
C.	Formal data agreements are not established with data providers	1.	Framework data becomes out of date.	4	3	High	P-P3	• Require completion of a formal data sharing agreement before utilizing data (II-C), • Include maintenance plans in front end plans for WA-Trans and facilitate them through out (II-C), • Include a regular QA cycle as part of WA-Trans maintenance to check for quality of data and maintenance over time (II-C1a, II-C2), • Update WA-Trans for ortho-photos and other sources where maintenance can't be relied upon (II-C) • **Include the cost of developing data sharing agreements in all budgets and schedules** (II-C) (*These costs are included in the current work plans*).
		2.	Data changes are not managed so the framework data has less credibility.	4	2	Mod	P-P3	
		3.	Framework is not used.	4	2	Mod	P-P3	
D.	Regular communication is inadequate or through mediums not easily accessible to partners	1.	Partners don't participate in project, meetings, or major decisions affecting them.	4	2	Mod	P1, P2, P3	• Develop a complete communication plan with different means of communicating with potential partners (II-D), • **Develop cost, resource and time assessments and publicize them** (II-D1, II-D2), (*Cost and resource estimates have been done using a couple of different assumptions*),
		2.	Partners don't provide funding and resources.	4	2	Mod	P1, P2, P3	

Legend

Impact Rating: *1* – Negligible, *2* – Marginal, *3* – Critical, *4* – Catastrophic
Probability Rating: *1* – Impossible, *2* – Improbable, *3* – Probable, *4* – Frequent
Risk Exposure Level: None, Moderate (Mod), High
Time: *P1* – Phase 1, *P2* – Phase 2, *P3* – Phase 3, *P-P3* – Post Phase 3

Bold Mitigation Strategy - Progress
Italicized Comments – Status of Mitigation

WA-Trans Project Risk Assessment
As of January 8, 2002

Risk #	*Risk Condition*	*Risk Consequence*		*Impact*	*Probability*	*Exposure*	*Time*	*Mitigation Strategy*
		3.	Business needs aren't identified or are identified in a non-timely way.	4	3	High	P1, P2, P3	*using a couple of different assumptions*), • Develop cost benefit analysis to justify participation and funding (II-D1, II-D2), • Allow sources of funding and resources greater say in prioritization process (II-D2), • **Continue to document different business needs so the project maintains information about what is needed by participants** (II-D3), (*Business needs definition is an ongoing process, but is now being handled in a less proactive manner*).
E.	Participation by partners dwindling over time	1.	Resources and funding are not made available for the project	3	3	Mod	P1, P2, P3	• **Provide processes for bringing new steering committee members in as those who can't continue to commit the time leave** (II-E), (*Rules of engagement are documented and in an informal way this process is in place*), • Develop a comprehensive communication plan which defines keeping partners engaged including regular communications and interpersonal efforts (II-E), • **Have each steering committee member designate an alternate who will serve in their place when the time runs out** (II-E), (*Several steering committee members do have alternates*), • Use alternative sources for data including orthophotos to compensate for missing data (II-E2). • **As people quit participating make contact with them and find out why. If possible address those issues so they reengage** (II-E), (*As time permits this is being done*).
		2.	Data needed for the framework is not made available	4	2	Mod	P3	
		3.	Competing efforts to develop a framework are established.	4	2	Mod	P3	
F.	New partners joining the project after project plan is in place	1.	Scope changes are required	3	2	Mod	P2, P3	• **Develop transition processes for introducing new partners to the process** (II-F), (*Rules of engagement are documented and in an informal way this process is in place*), • **Gather business needs for new partners and determine the commonalities with those already gathered** (II-F2), (*Business needs for all identified partners have been gathered, only missing those that have not been identified*),
		2.	Business drivers and priorities change	3	4	High	P2, P3	
		3.	Time is spent revisiting decisions reached earlier	4	2	Mod	P1, P2, P3	

Legend

Impact Rating: *1* – Negligible, *2* – Marginal, *3* – Critical, *4* – Catastrophic
Probability Rating: *1* – Impossible, *2* – Improbable, *3* – Probable, *4* – Frequent
Risk Exposure Level: None, Moderate (Mod), High
Time: *P1* – Phase 1, *P2* – Phase 2, *P3* – Phase 3, *P-P3* – Post Phase 3

Bold Mitigation Strategy - Progress
Italicized Comments – Status of Mitigation

Risk #	*Risk Condition*	*Risk Consequence*		*Impact*	*Probability*	*Exposure*	*Time*	*Mitigation Strategy*
		4.	The schedule and budget are exceeded	4	3	High	P1, P2, P3	• Develop change management process for handing scope changes once business requirements and prioritization is complete (II-F1, II-F2), • **Don't allow revisiting issues to occur unless the majority of the *steering committee* determines it is necessary to do so** (II-F3, II-F4), (*This is a "rule of engagement" of the steering committee which all have agreed to*), • **Provide new partners with all meeting notes so they don't have to revisit issues during meeting time and answer all their questions** (II-F1, II-F3, II-F4), (*Meeting notes are published on the project Web Site*), • Use phased approach for adding functionality and attribution and improving accuracy over time (II-F).

Legend

Impact Rating: *1* – Negligible, *2* – Marginal, *3* – Critical, *4* – Catastrophic
Probability Rating: *1* – Impossible, *2* – Improbable, *3* – Probable, *4* – Frequent
Risk Exposure Level: None, Moderate (Mod), High
Time: *P1* – Phase 1, *P2* – Phase 2, *P3* – Phase 3, *P-P3* – Post Phase 3

Bold Mitigation Strategy - Progress
Italicized Comments – Status of Mitigation

III. **Risk Category:** ***Ineffective Partnership*** **Cooperation –** Being unable to develop collectively approved standards and data model, being unable to resolve differences effectively.

Risk #	*Risk Condition*	*Risk Consequence*		*Impact*	*Probability*	*Exposure*	*Time*	*Mitigation Strategy*
A.	Different partners have directly conflicting requirements	1.	The project plan is not developed in a timely manner.	3	2	Mod	P1	• **Use steering committee to reduce the number of participants in the detailed discussion to more quickly resolve conflicts** (III-A), (*Steering Committee formed and active and making decisions*), • **Use negotiation techniques to resolve conflicts** (III-A), (*Project manager is seeking negotiation training*), • Used phased approach to demonstrate commitment to meeting all business needs (III-A1, III-A2, III-A3), • Focus on one group of partners at a time to manage scope (III-A) • Develop alternative plans so there is a view for how different priorities affect the project (III-A1), • Allow those with more unique business needs which don't share data or functionalities with common ones to pay for the additional cost of meeting their need (III-A3, III-A4), • **Look for common functionalities and data needed for all business needs and meet the most common requested in phase 1** (III-A), (*This strategy is being used based on the Pierce County application for determining business priority, data needs, and data availability*), • Use pilot to evaluate alternative approaches to provide data for resolving conflict (III-A)
		2.	Key partners abandon the effort.	4	2	Mod	P1	
		3.	Functionality agreed to does not meet the needs of partners.	4	2	Mod	P1	
		4.	Partners' data will not work with the framework.	4	2	Mod	P2, P3	
B.	Conflicts exist with security levels needed to meet identified business needs	1.	Some partners refuse to provide data.	4	3	High	P2, P3	• Gather security needs as part of the requirements process and allow some level of security of some data (ex. data for emergency services may be excluded from general access) (III-B1, III-B2, III-B3),
		2.	Data is provided to some who should not have access.	3	2	Mod	P-P3	

Legend

Impact Rating: *1* – Negligible, *2* – Marginal, *3* – Critical, *4* – Catastrophic
Probability Rating: *1* – Impossible, *2* – Improbable, *3* – Probable, *4* – Frequent
Risk Exposure Level: None, Moderate (Mod), High
Time: *P1* – Phase 1, *P2* – Phase 2, *P3* – Phase 3, *P-P3* – Post Phase 3

Bold Mitigation Strategy - Progress
Italicized Comments – Status of Mitigation

Risk #	*Risk Condition*	*Risk Consequence*		*Impact*	*Probability*	*Exposure*	*Time*	*Mitigation Strategy*
		3.	Partners have insufficient means of charging for cost of providing data.	2	2	Low	P2, P3	B3), • Develop a security system for updating data and for accessing data which facilitates security needs (III-B1, III-B2), • Provide a "public domain" version and other versions, attribution or layers for some specific users and uses (III-B1, III-B2), • Determine methods of funding which may include providing funds for offices which use data sales as a means of funding GIS programs (III-B3)
C.	Regular communication is inadequate or through mediums not easily accessible to partners	1.	Partners don't participate in project, meetings, or major decisions affecting them.	4	2	Mod	P1, P2, P3	• Develop a complete communication plan with different means of communicating with potential partners (III-C), • **Develop cost, resource and time assessments and publicize them** (III-C1, III-C2), (*Cost and resource estimates have been done using a couple of different assumptions*), • Develop cost benefit analysis to justify participation and funding (III-C1, III-C2), • Allow sources of funding and resources greater say in prioritization process (III-C2), • **Continue to document different business needs so the project maintains information about what is needed by participants** (III-C3), (*Business needs definition is an ongoing process, but is now being handled in a less proactive manner*).
		2.	Partners don't provide funding and resources.	4	2	Mod	P1, P2, P3	
		3.	Business needs aren't identified or are identified in a non-timely way.	4	3	High	P1, P2, P3	
D.	Inadequate cooperation between jurisdictional and political boundaries	1.	Data is missing	4	3	High	P3	• **Use the steering committee to minimize the cooperation complexity and coordinate the effort** (III-D), (*Steering Committee formed and active and making decisions*), • Develop software algorithms to facilitate data integration (III-D3), • Develop agreements and funding for supporting long term integration (III-D) • Provide option for "purchase" (RFQ) of data for short-term use (III-D1), • Use alternative sources for data including orthophotos to compensate for missing data (III-D1).
		2.	The framework isn't used	4	2	Mod	P-P3	
		3.	Data won't "connect"	3	2	Mod	P-P3	

Legend

Impact Rating: *1* – Negligible, *2* – Marginal, *3* – Critical, *4* – Catastrophic
Probability Rating: *1* – Impossible, *2* – Improbable, *3* – Probable, *4* – Frequent
Risk Exposure Level: None, Moderate (Mod), High
Time: *P1* – Phase 1, *P2* – Phase 2, *P3* – Phase 3, *P-P3* – Post Phase 3

Bold Mitigation Strategy - Progress
Italicized Comments – Status of Mitigation

WA-Trans Project Risk Assessment
As of January 8, 2002

Risk #	*Risk Condition*	*Risk Consequence*		*Impact*	*Probability*	*Exposure*	*Time*	*Mitigation Strategy*
E.	Difficulty reaching consensus regarding technical issues such as: conflicting segmentation criteria, data model design, attributes, and LRS measures.	1.	Partners decide not to participate	4	3	High	P1, P2, P3	• **Look at what other states are doing and at other standards (particularly RoadMAT) to get guidance on how to do this** (III-E), (*We have steering committee members on the RoadMAT team, steering committee members on National Map and Census TIGER/MAF Modernization projects. We also are working with OR through the IRICC*) • **Use lessons learned, standards and data models already implemented from other sources to prevent some of the same difficulties** (III-E), (*Seriously considering Oregon data model and trying to get lessons learned from other framework projects*), • Bring in a professional facilitator/negotiator to assist with the process of determining how to do this (III-E) • Bring in outside expertise to facilitate resolution of technical issues or to develop solutions to technical problems (III-E1, III-E2), • Allow a finite amount of time, add a contingency and then put the steering committee in a room until it is resolved. Bring the technicians in to provide feedback regarding the feasibility of the solution and refine as needed (III-E2, III-E2).
		2.	More time than is anticipated is spent resolving the issue	3	3	Mod	P1, P2, P3	
		3.	Identification of roads is significantly more complicated or costly	4	2	Mod	P2, P3	
F.	Difficulty supporting multiple topology and accuracy needs	1.	Partners decide not to participate	4	2	Mod	P1, P2, P3	• **Identify a minimum accuracy required and the minimum accuracy of data available for each item. Don't implement the business needs where the correct accuracy of data doesn't exist until it does exist** (III-F2, III-F3), (*minimal accuracy is being*
		2.	Some business needs are not met	3	4	High	P2, P3, P-P3	

Legend

Impact Rating: *1* – Negligible, *2* – Marginal, *3* – Critical, *4* – Catastrophic
Probability Rating: *1* – Impossible, *2* – Improbable, *3* – Probable, *4* – Frequent
Risk Exposure Level: None, Moderate (Mod), High
Time: *P1* – Phase 1, *P2* – Phase 2, *P3* – Phase 3, *P-P3* – Post Phase 3

Bold Mitigation Strategy - Progress
Italicized Comments – Status of Mitigation

Risk #	*Risk Condition*	*Risk Consequence*		*Impact*	*Probability*	*Exposure*	*Time*	*Mitigation Strategy*
		3.	Increased cost and time of developing the framework	3	3	Mod	P1, P2, P3	**until it does exist** (III-F2, III-F3), (*minimal accuracy is being identified both on data needed, and accuracy identified for existing data*) • Identify data that is missing or less accurate than needed and present that information to the WAGIC and the Geographic Subcommittee and try to develop momentum and funding for development of such accuracy (III-F). • Try to predict when the needed accuracy is available and using a phased approach set up your phases of improvement to handle upgrading accuracy when the needed data is available (III-F1, III-F2, III-F3).
G.	Difficulty building necessary consensus with a multi-participant setting	1.	Timelines and/or budgets are not met	4	3	High	P1, P2, P3	• Determine individual participants needs and motivations and then find the commonalities and try to meet those common needs (III-G2, III-G3), • **Use the steering committee to reduce the number of participants in the detailed discussion to more quickly resolve conflicts** (III-G), (*Steering Committee formed and active and making decisions*), • **Use negotiation techniques and, where needed, a professional negotiator to resolve differences** (III-G), (*Project manager is seeking negotiation training*), • Develop an alternative analysis so there is a view for how different priorities affect the project (III-G3), • Allow those with more unique business needs which don't hare data or functionalities with common ones to pay for the additional cost of meeting their needs (III-G1, III-G2), • Use pilots to evaluate alternative approaches to provide data for resolving conflict (III-G3).
		2.	Partners decide not to participate	4	3	High	P1, P2, P3	
		3.	Results do not meet partner business needs	3	3	Mod	P3	
H.	Participation by partners dwindling over time	1.	Resources and funding are not made available for the project	3	3	Mod	P1, P2, P3	• **Provide processes for bringing new steering committee members in as those who can't continue to commit the time leave** (III-H), (*Rules of engagement are documented and in an*

Legend

Impact Rating: *1* – Negligible, *2* – Marginal, *3* – Critical, *4* – Catastrophic
Probability Rating: *1* – Impossible, *2* – Improbable, *3* – Probable, *4* – Frequent
Risk Exposure Level: None, Moderate (Mod), High
Time: *P1* – Phase 1, *P2* – Phase 2, *P3* – Phase 3, *P-P3* – Post Phase 3

Bold Mitigation Strategy - Progress
Italicized Comments – Status of Mitigation

Risk #	*Risk Condition*	*Risk Consequence*		*Imp-act*	*Prob-ability*	*Expo-sure*	*Time*	*Mitigation Strategy*
		2.	Data needed for the framework is not made available	4	2	Mod	P3	**leave** (III-H), (*Rules of engagement are documented and in an informal way this process is in place*), • **Develop a comprehensive communication plan which defines keeping partners engaged including regular communications and interpersonal efforts** (III-H), (*There is not yet a written plan, but there is a project web site that is updated regularly, regularly meetings are held for both partners and the steering committee, all notes are published on the web site and a status report is generally sent out monthly and published on the web site)*, • **Have each steering committee member designate an alternate who will serve in their place when the time runs out** (III-H), (*Several steering committee members do have alternates*), • Use alternative sources for data including orthophotos to compensate for missing data (III-H2). • **As people quit participating make contact with them and find out why. If possible address those issues so they reengage** (III-H), (*As time permits this is being done*).
		3.	Competing efforts to develop a framework are established.	4	2	Mod	P3	

Legend

Impact Rating: *1* – Negligible, *2* – Marginal, *3* – Critical, *4* – Catastrophic
Probability Rating: *1* – Impossible, *2* – Improbable, *3* – Probable, *4* – Frequent
Risk Exposure Level: None, Moderate (Mod), High
Time: *P1* – Phase 1, *P2* – Phase 2, *P3* – Phase 3, *P-P3* – Post Phase 3

Bold Mitigation Strategy - Progress
Italicized Comments – Status of Mitigation

IV. **Risk Category:** ***Private-Government Partnership Issues*** – Private companies have data that assists governments to make decisions about project and operationally. How this data is gathered, used, and distributed may make a big difference in the success of WA-Trans.

Risk #	*Risk Condition*	*Risk Consequence*		*Imp -act*	*Prob-ability*	*Expo-sure*	*Time*	*Mitigation Strategy*
A.	Conflicts exist with security levels needed to meet identified business needs	1.	Some partners refuse to provide data.	4	3	High	P2, P3	• Gather security needs as part of the requirements process and allow some level of security of some data (ex. data for emergency services may be excluded from general access) (IV-A1, IV-A2, IV-A3), • Develop a security system for updating data and for accessing data which facilitates security needs (IV-A1, IV-A2), • Provide a "public domain" version and other versions, attribution or layers for some specific users and uses (IV-A1, IV-A2), • Determine methods of funding which may include providing funds for offices which use data sales as a means of funding GIS programs (IV-A3)
		2.	Data is provided to some who should not have access.	3	2	Mod	P-P3	
		3.	Partners have insufficient means of charging for cost of providing data.	2	2	Low	P2, P3	
B.	Inability to form partnerships with the private sector	1.	Business needs are not identified	4	3	High	P1, P2, P3	• **Make outreach to logical private partners just as public ones have been included** (IV-B), (*this outreach is beginning soon, the focus being on funding opportunities*), • **Identify partners which could provide data and expertise and those which may be able to use WA-Trans and have funds to contribute** (IV-B2, IV-B3), (*We are currently identifying potential partners who may have interest and eventually be able to provide funding*), • Use private contacts to find new private contacts and continue to work with them (IV-B), • Determine limitations of public-private partnerships and exploit those where it is logical to do so (IV-B).
		2.	New technologies or methods which could assist are not made available	3	2	Mod	P2, P3	
		3.	Opportunities to leverage data sharing agreements with private partners are not leveraged	3	3	Mod	P2, P3	
C.	Conflict regarding public disclosure laws and the need to share data and the need for data some don't want	1.	Opportunities for getting data from private organizations (utilities, private forest land owners) complex or impossible	3	4	High	P2, P3	• Include private data providers in the planning process to assist with developing strategies for handling data and data sharing requests (IVC), • **Get legal opinion from State Attorney General's Office regarding public disclosure laws and limits and data sharing**

Legend

Impact Rating: *1* – Negligible, *2* – Marginal, *3* – Critical, *4* – Catastrophic
Probability Rating: *1* – Impossible, *2* – Improbable, *3* – Probable, *4* – Frequent
Risk Exposure Level: None, Moderate (Mod), High
Time: *P1* – Phase 1, *P2* – Phase 2, *P3* – Phase 3, *P-P3* – Post Phase 3

Bold Mitigation Strategy - Progress
Italicized Comments – Status of Mitigation

Risk #	*Risk Condition*	*Risk Consequence*		*Imp-act*	*Prob-ability*	*Expo-sure*	*Time*	*Mitigation Strategy*
	shared.	2.	Public disclosure forces providing data that is to be kept private, except for particular uses (emergency response) to the public.	2	3	Mod	P3	**regarding public disclosure laws and limits and data sharing ("licensing") agreements between various levels of government and private organizations and government** (IVC), (*Framework Management Group is going to handled this with input from WA-Trans project*), • Set up a process that makes getting data provided by private organizations difficult and allows notification of the original data provider so they can get involved (IVC2).

Legend

Impact Rating: *1* – Negligible, *2* – Marginal, *3* – Critical, *4* – Catastrophic
Probability Rating: *1* – Impossible, *2* – Improbable, *3* – Probable, *4* – Frequent
Risk Exposure Level: None, Moderate (Mod), High
Time: *P1* – Phase 1, *P2* – Phase 2, *P3* – Phase 3, *P-P3* – Post Phase 3

Bold Mitigation Strategy - Progress
Italicized Comments – Status of Mitigation

V. **Risk Category:** ***Network Infrastructure and Technology Shortcomings –*** Having the ability to update and retrieve WA-Trans data statewide is key to successful long-term usability of the product.

Risk #	*Risk Condition*	*Risk Consequence*		*Imp-act*	*Prob-ability*	*Expo-sure*	*Time*	*Mitigation Strategy*
A.	Band width doesn't support data exchange	1.	Data transfer viewed as "too slow" by framework users (lower satisfaction).	4	3	High	P2, P3	• Pilot testing of the largest most complex data sets to troubleshoot packet size and number of packets transferred (V-A1), • Contract out hosting of WA-Trans, with minimum specifications for speed, bandwidth (V-A1, V-A2).
		2.	Framework is not used.	4	1	Low	P3	
		3.	Negative impact on "hosting organization's" network speed and local applications.	4	2	Mod	P3	
B.	Technology is not available or is too costly to implement to support the vision of WA-Trans such as desired attribution, complex functionality, accuracy, access speed, or ease of update.	1.	Framework does not meet business needs and is not used.	4	3	High	P3	• Bring technical experts and companies in to determine feasibility of plans, standards and data models prior to implementation (V-B), • Use pilot projects to determine the feasibility, cost and risk of doing using new techniques and technologies (V-B), • Determine the cost of using new technology where available, including the learning curve, with the cost of using older technology when making technical decisions (V-B), • Develop a technical team, which reports to the steering committee to resolve technical and technology issues and advise the steering committee on how best to implement them (V-B).
		2.	Attempts to make the framework work with less effective technology fail or take extra time costing significant funding and time.	4	2	Mod	P2, P3	
		3.	WA-Trans fails at implementation.	4	2	Mod	P2, P3	

Legend

Impact Rating: *1* – Negligible, *2* – Marginal, *3* – Critical, *4* – Catastrophic
Probability Rating: *1* – Impossible, *2* – Improbable, *3* – Probable, *4* – Frequent
Risk Exposure Level: None, Moderate (Mod), High
Time: *P1* – Phase 1, *P2* – Phase 2, *P3* – Phase 3, *P-P3* – Post Phase 3

Bold Mitigation Strategy - Progress
Italicized Comments – Status of Mitigation

VI. **Risk Category:** ***Compatibility of Data Standards, Boundaries and Deliverable Timetables*** **-** Gathering data from a variety of sources and formats, putting it together in a meaningful way and serving it back up to be useful statewide is the difficulty.

Risk #	*Risk Condition*	*Risk Consequence*		*Imp-act*	*Prob-ability*	*Expo-sure*	*Time*	*Mitigation Strategy*
A.	The project is unable to schedule key resources at the needed time	1.	The project schedule is not followed.	3	4	High	P1, P2, P3	• Communicate costs of changes to partners on a regular basis (VI-A1, VI-A2, VI-A4), • Have alternatives planned for each resource (VI-A1, VI-A2, VI-A4), • Use change management process to deal with resource losses (VI-A1, VI-A2), • Develop alternative schedules for various resource combinations (VI-A1, VI-A2, VI-A4), • Balance use of contractors with technicians with long term value of WA-Trans to keep knowledge (VI-A3), • Use contractors only for simple, repetitive tasks and other staff for key integration decisions and development of processes requiring long term maintenance (VI-A3), • Accept the loss of knowledge and make up for it in the maintenance process (VI-A3), • Contract out maintenance as well (VI-A3).
		2.	The deliverables are not completed on time.	3	3	Mod	P1, P2, P3	
		3.	Contractors work the project and key knowledge is lost.	2	2	Low	P3	
		4.	Knowledge about data is not available thus tasks and mistakes consume time inefficiently.	2	3	Mod	P2, P3	
B.	The business needs identified by funding organizations are too complex for time available to develop the first release	1.	Funding opportunities are lost.	4	3	High	P3	• Provide option for "purchase" (RFQ) of data for short-term use (VI-B1, VI-B2), • Perform continuous risk management including assessing the risks of each requirement to meet a business needs (VI-B), • Add a contingency factor in the budget and schedule for risk assessed on complex business needs (VI-B), • Use a carefully constructed RFP to contract out the complex portions of the project and share the risk with the contractor (VI-B), • Provide a release of WA-Trans that is a starting point for them and they can adapt and refine it to meet their specific needs (VI-B).
		2.	Competing base-maps/frameworks are established	4	2	Mod	P3	
		3.	The framework project "fails" when it tries to meet a need that is too high- risk for first release.	4	2	Mod	P2, P3	

Legend

Impact Rating: *1* – Negligible, *2* – Marginal, *3* – Critical, *4* – Catastrophic
Probability Rating: *1* – Impossible, *2* – Improbable, *3* – Probable, *4* – Frequent
Risk Exposure Level: None, Moderate (Mod), High
Time: *P1* – Phase 1, *P2* – Phase 2, *P3* – Phase 3, *P-P3* – Post Phase 3

Bold Mitigation Strategy - Progress
Italicized Comments – Status of Mitigation

WA-Trans Project Risk Assessment
As of January 8, 2002

Risk #	*Risk Condition*	*Risk Consequence*		*Imp-act*	*Prob-ability*	*Expo-sure*	*Time*	*Mitigation Strategy*
C.	Development of the base-map with attribution is too slow for some business needs identified	1.	Funding/resource opportunities are lost.	4	4	High	P1, P2, P3	• Attach a funding requirement to meeting urgent needs (VI-C), • Provide option for "purchase" (RFQ) of data for short-term use (VI-C2), • Use pilot to show value of providing data in WA-Trans (VI-C3), • Consider a scaled down version for a first release, with a release schedule for addition attribution (VI-C). • Determine if there is a regional prioritization and do those first (VI-C).
		2.	Competing base-maps/frameworks are established.	4	2	Mod	P3	
		3.	Some potential partner's data is not available.	4	3	High	P3	
D.	Partners don't have funds to provide data in a format needed for the transportation framework.	1.	Some stockholder's data is not available for the framework.	4	2	Mod	P2, P3	• **Include the need for funding activities for data providers in funding proposals and requests** (VI-D), (*One of the estimates used for a grant request included some money for these activities*), • Develop translators to convert the data into the correct format for WA-Trans, (VI-D1, VI-D2) • Provide some sort of grant program so those with data and funding needs can get a grant to assist with this activity (VI-D1, VI-D2) • Staff WA-Trans with staff members that can go to the data providers to do this work with and for them (VI-D1, VI-D2), • Use the pilot to determine factors, which help estimate costs and time for individual providers to convert their data and use this information when seeking funding and in CBAs (VI-D1, VI-D2, VI-D4).
		2.	Partners don't participate in the project.	4	2	Mod	P2, P3	
		3.	Framework is not used due to not having the "best available" data.	4	2	Mod	P-P3	
		4.	Framework costs more to convert data.	3	4	High	P2, P3	
E.	Expectation that the framework interface with specialized applications with proprietary formats	1.	Partners decide not to participate	4	2	Mod	P1, P2, P3	• **Prioritize business needs and determine a plan for meeting all reasonable business needs which facilitates specific application needs over time** (VI-E), (*Business needs are being prioritized and a plan will be underway upon completion*), • Identify the most commonly needed data elements and a standard which is the simplest way of storing the data and then provide translators into and out of the database so it can interface with a
		2.	Some business needs are not met	3	3	Mod	P1, P2, P3	
		3.	Costs of developing some applications using the framework are more expensive	3	2	Mod	P-P3	

Legend

Impact Rating: *1* – Negligible, *2* – Marginal, *3* – Critical, *4* – Catastrophic
Probability Rating: *1* – Impossible, *2* – Improbable, *3* – Probable, *4* – Frequent
Risk Exposure Level: None, Moderate (Mod), High
Time: *P1* – Phase 1, *P2* – Phase 2, *P3* – Phase 3, *P-P3* – Post Phase 3

Bold Mitigation Strategy - Progress
Italicized Comments – Status of Mitigation

Risk #	*Risk Condition*	*Risk Consequence*		*Imp-act*	*Prob-ability*	*Expo-sure*	*Time*	*Mitigation Strategy*
		4.	The framework isn't used	4	2	Mod	P-P3	translators into and out of the database so it can interface with a variety of formats and business needs (VI-E2, VI-E3), • Designate a clear scope which defines what is in WA-Trans and what is not so it is clear from a vary early time which business needs will and will not be met with WA-Trans (VI-E2), • Used a phased implementation to include more data formats and specialized needs in later versions of implementations thus not being exclusionary (VI-E3).
F.	Partners' conditions and expectations change over time.	1.	Partners quit participating	4	2	Mod	P1, P2, P3	• Clearly define the scope of each implementation phase and use change management to facilitate when that scope needs to change (VI-F2), • **Maintain the business needs document over time so changing business climates are being documented** (VI-F1, VI-F3), (*Business needs definition is an ongoing process, but is now being handled in a less proactive manner*) • Develop a long-term maintenance plan, which includes how continuing improvements can be made to WA-Trans (VI-F1, VI-F3).
		2.	The scope of the project changes	4	2	Mod	P2, P3	
		3.	Partners business needs are not met	3	3	Mod	P3	
G.	Concern of partners regarding control and time issues of shared resources and funding	1.	Resources and funding are not made available for the project	3	3	Mod	P1, P2, P3	• Develop comprehensive roles and responsibilities and associated work plan for each shared resource which defines control, coordination and work tasks and deliverables (VI-G1, VI-G2), • Document each change of resources and what the cost in terms of time, money and expertise to the project in an effort to illustrate the need for resource commitment (VI-G2, VI-G3), • Develop plans with resources provided by sharing and without to show costs and time associated with each and where resources can't be provided seek funding to make up the difference (VI-G).
		2.	Constraints are placed upon use of resources or funds	2	3	Mod	P1, P2, P3	
		3.	The project takes more time than planned	3	3	Mod	P1, P2, P3	
H.	Competing base-maps/frameworks are established.	1.	The other project compete for the same funds as WA-Trans	4	4	High	P1, P2, P3	• Look for opportunities to share efforts, resources and project scopes wherever possible (VI-H).

Legend

Impact Rating: *1* – Negligible, *2* – Marginal, *3* – Critical, *4* – Catastrophic
Probability Rating: *1* – Impossible, *2* – Improbable, *3* – Probable, *4* – Frequent
Risk Exposure Level: None, Moderate (Mod), High
Time: *P1* – Phase 1, *P2* – Phase 2, *P3* – Phase 3, *P-P3* – Post Phase 3

Bold Mitigation Strategy - Progress
Italicized Comments – Status of Mitigation

VII. **Risk Category***: **Facilitating Development of the Most Useful Applications*** – WA-Trans doesn't develop applications, but it must facilitate the development of them. If the needed data isn't available through WA-Trans those applications can't be developed.

Risk #	*Risk Condition*	*Risk Consequence*		*Imp-act*	*Prob-ability*	*Expo-sure*	*Time*	*Mitigation Strategy*
A.	The project is unable to schedule key resources at the needed time	1.	The project schedule is not followed.	3	4	High	P1, P2, P3	• Communicate costs of changes to partners on a regular basis (VII-A1, VII-A2, VII-A4), • Have alternatives planned for each resource (VII-A1, VII-A2, VII-A4), • Use change management process to deal with resource losses (VII-A1, VII-A2), • Develop alternative schedules for various resource combinations (VII-A1, VII-A2, VII-A4), • Balance use of contractors with technicians with long term value of WA-Trans to keep knowledge (VII-A3), • Use contractors only for simple, repetitive tasks and other staff for key integration decisions and development of processes requiring long term maintenance (VII-A3), • Accept the loss of knowledge and make up for it in the maintenance process (VII-A3), • Contract out maintenance as well (VII-A3).
		2.	The deliverables are not completed on time.	3	3	Mod	P1, P2, P3	
		3.	Contractors work the project and key knowledge is lost.	2	2	Low	P3	
		4.	Knowledge about data is not available thus tasks and mistakes consume time inefficiently.	2	3	Mod	P2, P3	
B.	The business needs identified by funding organizations are too complex for time available to develop the first release	1.	Funding opportunities are lost.	4	3	High	P3	• Provide option for "purchase" (RFQ) of data for short-term use (VII-B1, VII-B2), • Perform continuous risk management including assessing the risks of each requirement to meet a business needs (VII-B), • Add a contingency factor in the budget and schedule for risk assessed on complex business needs (VII-B), • Use a carefully constructed RFP to contract out the complex portions of the project and share the risk with the contractor (VII-B), • Provide a release of WA-Trans that is a starting point for them and they can adapt and refine it to meet their specific needs (VII-B).
		2.	Competing base-maps/frameworks are established	4	2	Mod	P3	
		3.	The framework project "fails" when it tries to meet a need that is too high- risk for first release.	4	2	Mod	P2, P3	

Legend

Impact Rating: *1* – Negligible, *2* – Marginal, *3* – Critical, *4* – Catastrophic
Probability Rating: *1* – Impossible, *2* – Improbable, *3* – Probable, *4* – Frequent
Risk Exposure Level: None, Moderate (Mod), High
Time: *P1* – Phase 1, *P2* – Phase 2, *P3* – Phase 3, *P-P3* – Post Phase 3

Bold Mitigation Strategy - Progress
Italicized Comments – Status of Mitigation

WA-Trans Project Risk Assessment
As of January 8, 2002

Risk #	*Risk Condition*	*Risk Consequence*		*Imp-act*	*Prob-ability*	*Expo-sure*	*Time*	*Mitigation Strategy*
C.	Pilot projects are completed before a detailed business needs assessment is completed	1.	Pilots are deemed not useful because they don't represent needs and don't meet business requirements.	3	2	Mod	P2	• **Develop a schedule which begins pilots after completion of business needs assessment and requirements analysis** (VII-C2), (*The current schedule has pilots directly following needs assessment and requirements analysis and development of the data model*), • Perform risk management on pilots done prior to completion of business needs assessment and requirements analysis to determine and document how likely they are to represent the final version of WA-Trans (VII-C1), • Perform change management on any scope changes that includes the costs of pilots, which are different and results, which must be negated (VII-C1).
		2.	Pilots compete for scarce resources with gathering business needs thus having less than needed for both.	2	2	Low	P1, P2	
D.	Business needs are not identified during the business needs assessment effort	1.	Scope changes occur later in the process (costing more money) because new needs are identified.	2	3	Mod	P2, P3	• **Make an effort to identify as many players as possible as early as possible to get complete needs collected** (VII-D1), (*This has been done. Some groups have not had much contact made with them in the interests of prioritizing limited time of the project manager, but they have been identified*), • Develop change management process for handing scope changes once business requirements and prioritization is complete (VII-D1), • Use phased approach for adding functionality and attribution and improving accuracy over time (VII-D2), • **Continue to document different business needs so the project maintains information about what is needed by participants** (VII-D2), (*Business needs definition is an ongoing process, but is now being handled in a less proactive manner*).
		2.	Some partners don't participate because they don't see TFW meeting "their" business needs.	3	3	Mod	P2, P3	
E.	Expectation that the framework interface with specialized applications with proprietary formats	1.	Partners decide not to participate	4	2	Mod	P1, P2, P3	• **Prioritize business needs and determine a plan for meeting all reasonable business needs which facilitates specific application needs over time** (VII-E), (*Business needs are being prioritized and a plan will be underway upon completion*), • Identify the most commonly needed data elements and a standard which is the simplest way of storing the data and then provide
		2.	Some business needs are not met	3	3	Mod	P1, P2, P3	

Legend

Impact Rating: *1* – Negligible, *2* – Marginal, *3* – Critical, *4* – Catastrophic
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Risk #	*Risk Condition*	*Risk Consequence*		*Imp-act*	*Prob-ability*	*Expo-sure*	*Time*	*Mitigation Strategy*
		3.	Costs of developing some applications using the framework are more expensive	3	2	Mod	P-P3	which is the simplest way of storing the data and then provide translators into and out of the database so it can interface with a variety of formats and business needs (VII-E2, VII-E3), • Designate a clear scope which defines what is in WA-Trans and what is not so it is clear from a vary early time which business needs will and will not be met with WA-Trans (VII-E2), • Used a phased implementation to include more data formats and specialized needs in later versions of implementations thus not being exclusionary (VII-E3).
		4.	The framework isn't used	4	2	Mod	P-P3	

[i] Software Engineering Institute, (1996), Continuous Risk Management Guidebook, Carnegie Mellon University pg.41-45.
[ii] Dueker, K. and Bender, P. (2001), "White Paper on Issues and Strategies for Building a State Transportation Framework", http://www.wsdot.wa.gov/mapsdata/transframework/Trans%20White%20Paper%20Final.pdf
[iii] Dueker, K. and Bender, P. (2001), "White Paper on Issues and Strategies for Building a State Transportation Framework", http://www.wsdot.wa.gov/mapsdata/transframework/Trans%20White%20Paper%20Final.pdf

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Italicized Comments – Status of Mitigation

WA-Trans Pilot Projects Objectives

June 2, 2003

Introduction

The Washington Transportation Framework for GIS Project (WA-Trans) is organized to develop a core geo-spatial transportation representation for the State of Washington to be used for a variety of business needs. These business needs have been documented and prioritized by the WA-Trans Steering Committee. The project will be scoped to facilitate meeting the top priority business needs first. A risk assessment has been completed and several risks were identified with implementation. As part of risk management, pilot projects were identified as a risk mitigation strategy. Additionally, pilot projects are seen as a way to prove WA-Trans a viable solution to facilitating meeting the identified business needs and providing a "workshop" for developing processes that will support a statewide implementation and long-term operations of a transportation framework.

This documents the goals/objectives of any pilot projects considered for WA-Trans. Each pilot must meet some of these objectives to be deemed viable for inclusion. An additional goal of this document is to provide a checklist to make sure all objectives are met by a pilot or, more realistically, a combination of pilots to provide more complete risk mitigation and prepare the project for statewide implementation.

Project Management Objectives:

- Clearly define which objectives are to be met by each pilot in a formal "mini-charter" as defined in the WA-Trans Charter. Include scope, roles, responsibilities and deliverables in mini-charter.
- Clearly define a scope, schedule and budget prior to beginning technical work on any pilot and then track against all. Document results.
- Satisfy business needs identified in each pilot scope for each pilot using transportation applications that will demonstrate benefits of time spent or cost savings. Make sure the scope include some business needs that are identified as high priority in the business need prioritization process. Whatever pilots we do could address these issues:
    - Event Location Analysis and Mapping (Geocoding/Address-matching)
    - Map Production
    - Accurate centerline
    - Street Names
    - Roads Inventory Information such as that shared with CRAB (County, Tribal, City, State)
- Develop a communication plan for each pilot. Plan must include process for identifying potential partner organizations and engaging them in the pilot.
- Develop formal agreements regarding scope and role of WA-Trans with partner organizations, which will use the results of pilot efforts.
- Develop change management process for each pilot.

WA-Trans Pilot Projects Objectives

June 2, 2003

Design and Implementation Objectives:

- Identify, refine, or develop a workable data model that can be tested during various pilots. Design needs to include links to make the model multi-modal. Document results of tests.
- Use metadata standards that will facilitate the use of disparate data statewide. All Washington framework projects are required to follow the ISB standards for Horizontal Datum and Coordinate System Standard and for Metadata (see http://wagic.wa.gov/Techstds2/standards_index.htm).
- Fully document and test the data integration aspects of developing a common transportation database across jurisdictions (counties, county/city, state/local, county/tribal) and identify issues and methods to resolve issues.
- Develop and test processes for providing data for a locality that does not have it's own data or will not participate.
- Identify, document and test related utilities for transportation framework, including but not limited to security, access for view, download or maintenance of data, translation of disparate data formats and standards both for input and output of data.

Operational Objectives:

- Develop maintenance procedures for maintaining data developed for a locality that does not have it's own data or will not participate.
- Test or document how transportation framework data set can be updated on a regular basis as required by business needs and other required maintenance.
- Define and test QA/QC processes for data.
- Develop and test formal data sharing agreements with partner jurisdictions and processes for completion of data sharing agreements. This should include data steward roles and maintenance.
- Develop and test license agreement language for pilots.
- Develop processes and roles for long-term change management of WA-Trans and test in pilots.

Coordination Between Pilot Projects

- Develop a coordination plan to assure pilots work toward statewide implementation goals.
- Develop one data model and change management process for the model that applies to all pilots.
- The statewide implications of all pilot decisions are considered and documented.
- A dispute resolution process will be in place for conflicts between needs of multiple pilots. Resolution will always be based upon statewide implementation considerations.

WA-Trans Pilot Projects Objectives

June 2, 2003

- Processes are shared and adjusted across pilots in the effort to develop processes that can be used in a statewide implementation.
- Pilot implementations will be developed to facilitate immediate inclusion in the first statewide implementation

Results Analysis and Follow Up Objectives:

- Document lessons learned in all areas.
- Evaluate satisfaction of business needs.
- Perform cost-benefit analysis of applications and data development.
- Develop a report for each pilot that can be shared regarding the findings.
- Develop cost and time estimates to develop framework for other jurisdictions and other business needs.
- Define scope of the first release of WA-Trans.
- Determine where WA-Trans will “reside”.
- Communicate the results and conclusions of the pilot to participants and leaders.

White Paper on Issues and Strategies for Building a State Transportation Framework

Kenneth J. Dueker
Professor of Urban Studies and Planning
duekerk@pdx.edu

Paul Bender
Graduate Research Assistant
benderp@pdx.edu

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Center for Urban Studies
College of Urban and Public Affairs
Portland State University
Portland, OR 97207
http://www.upa.pdx.edu/CUS/

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State Transportation Framework

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Executive Summary

The purpose of this white paper is to systematically re-examine transportation data sharing issues that have been discussed at length, but in a manner to foster final decisions and closure. In some cases, choices among alternatives may require more detailed analysis or pilot studies. The development of this document has benefited from discussion at the Interorganizational Resource Information Coordinating Council (IRICC) Roads Committee, which has led to this consensus document. This sixth and final version serves to draw the process to a close and recommends a twofold approach to the development of a Transportation Framework. It also recommends six pilot studies to examine remaining issues in more detail.

This White Paper posits two purposes for the Transportation Framework. First, the Framework can be considered a set of coordinated map layers comprised of point, line, and area objects representing the location and extent of transportation features that is **complete, consistent, and current**. This part of the Transportation Framework provides a source of "best available" linework that would be updated periodically, probably on an annual basis. This representation would serve **planning business needs** for a limited range of transportation and non-transportation organization stakeholder applications. It may also support a limited number of **operations** type applications, such as pathfinding for rerouting and permitting. Individual users can assess it for fitness to their application. In many instances the Transportation Framework may need augmentation for specific applications. For example, many business needs, such as transportation planning, congestion management, etc., require at least a bi-directional centerline if not dual carriageways or even individual lanes, either in the basic geometry or by attribution. These needs may be too specific or time sensitive to include within general use data for which the Framework is responsible.

The second purpose of the Transportation Framework scope is to facilitate updates. This would entail a **Clearinghouse of new and modified road features** that is collected in the form of transactions. These transactions would be derived from construction projects undertaken by or on behalf of transportation organizations. They are then accumulated in the Clearinghouse and used to update the Transportation Framework's complete, consistent, and current representation of the transportation system. In addition, organizations that maintain their own transportation databases could select updates for transportation features deposited by all transportation organizations for their region of interest.

This twofold approach satisfies the need to facilitate updating the best available data, while at the same time making more detailed data available pertaining to new and modified transportation features. This will support those who need updates of more detailed content and greater spatial and temporal accuracy.

The business needs of GIS applications in the areas of natural resource management, infrastructure management, emergency management, and services management

applications were assessed. We conclude that the Transportation Framework should focus on supporting **planning** functions initially, with very limited support for the needs of **operations**. In a longer timeframe, a more robust Transportation Framework, one having greater spatial and temporal accuracy and more detailed attribution, could support more management and operations functions. But initially the requirements and standards for the Transportation Framework are translated to spatial data set and GIS functional requirements that support planning functions. These requirements are both a consistent spatial and temporal accuracy across Framework layers, and a consistent representation of transportation within and across jurisdictions. The initial requirements and standards for the Transportation Framework to support planning functions require coordination and sharing of data resources that extend to other Framework layers and to other jurisdictions.

It is important that all Framework participants acknowledge that the Transportation Framework is not intended to be a replacement for their transportation databases, so it does not have to, nor should it, contain the detail or the robustness to satisfy all their applications. Yet their databases may be derived from the Transportation Framework and should be updated from transactions from the Clearinghouse of new or modified transportation features.

Those organizations that contribute data to the Transportation Framework are assured that other organizations have access to the most current and accurate inter-organizational data. Those organizations that access data from the Transportation Framework are likewise insured that they have access to the most current and accurate inter-organizationally planning data that is available. Similarly, within organizations, there is a need to share data to avoid the problems of stovepipe systems that duplicate basic data and lead to inconsistent representations with varying degrees of spatial and temporal accuracy.

The main objective is to reduce the number of redundant project-level databases that decay over time and substitute a Transportation Framework that is easy to access and can respond to varied planning-level business needs of the numerous organizations with pieces of the transportation puzzle. Consequently, the Transportation Framework fosters use of the best available data, and relies on data sharing mechanisms to maintain its currency.

A tension between simplicity and robustness resulted in the realization that a complete, consistent and current representation of roads is needed, but the Transportation Framework cannot meet all business needs for road data. Yet, the Framework should play a major role in collecting data concerning new or modified roads that will enable updating and improving the complete representation of roads.

This learning process led to the establishment of the following criteria and design principles for the Transportation Framework (Roads):

- Compile “best available” data from existing imagery and GIS resources to create a complete, consistent, and current roadway system. Attribute it minimally to support simple routing applications.

- Enable its gradual improvement in spatial accuracy and correspondence with other layers on an as-needed, ad-hoc basis by means of a check-out/check-in process for regions undergoing detailed study.
- Enable the addition of content detail and spatial accuracy from engineering CADD data and inventory databases. This necessitates that the Transportation Framework includes a roadway identification schema and linear referencing.
- Establish an explicit periodic updating process to keep the complete representation of the road system current.
- Capture data when roads are created or modified. Begin the capture of these data on a **day-forward** basis as *transactions* as the best means to update the complete representation of the road system.
- Create a **clearinghouse** of these transactions from which other road database users can query and select data to maintain and update their own organizations' data.
- Create incentives, mandates, guidance, and technical assistance to transportation organizations to foster the reporting of metadata relating to all of the activities outlined above.

Six pilot studies are identified to address outstanding issues:

1. Pilot Study 1 is being conducted by ODOT. They are building a complete Roads database in Wasco County to demonstrate the feasibility of conflating data.
2. Pilot Study 2 is proposed for a county in Washington State. Pilot Study 2 would test the feasibility of compiling a complete Roads database by a process of handoffs from one organization to another, each adding roads from their GIS database.
3. Pilot Study 3 is proposed for a group of counties in Washington State that do not have complete GIS data and would not be able to participate in a process as proposed in Pilot Study 2. Pilot Study 3 would contract with a roads database vendor to build and maintain the Transportation Framework (Roads).
4. Pilot Study 4 is proposed for a jurisdiction in Washington State interested in moving their Roads data to an enterprise-wide database. Pilot Study 4 would involve not only building a transaction updated Roads database, but would require extracting data in a consistent format from projects, permits, and work orders that build or modify roads and intersections.
5. Pilot Study 5 is proposed to test the Clearinghouse concept. Pilot Study 5 would build a web-based collection of data about new and modified Roads.
6. Pilot Study 6 is a test of withdrawing data from the Clearinghouse and updating Roads databases.

Three options are identified and described. These may be considered as functional "add-ons" to the basic, "best available" roads linework of a Framework that satisfies many GIS needs, including tight integration of the Transportation Framework (Roads) with other NSDI layers. There is great interest and need for integrating hydrography, cadastral, roads, railroads and bridge structures, including culverts, for salmon enhancement planning. In addition, this will include spatial accuracy

improvements to the best available linework to support limited vehicle-tracking applications.

Three optional enhancements to the basic linework follow directly from the analysis and identification of business needs:

- Address ranges and street names. Address geocoding functionality is of great interest and importance to emergency dispatch agencies and to many other users of address geocoding.
- Linear Referencing Systems (LRS) to support adding attributes of roads for and infrastructure (IMS) management.
- Network representations of the roadway system to support routing applications, such as disaster and contingency planning. Overweight/oversize truck routing would require additional data of height, weight and turn restrictions.

The three options listed above can be prioritized for phased implementation and to identify stakeholders willing to pay for the enhancement**.** A rough estimate of cost for compiling the basic linework statewide is estimated to be $1,000,000 per state (Washington and Oregon). This estimate does not include administration or management of the compilation process. Nor does it include the time and cost of determining exactly what data should be used, setting up data sharing partnerships, and other aspects of incorporating the concerns of stakeholders. Each additional option is estimated to cost $250,000 per state. The add-on cost of additional enhancements should be the responsibility of stakeholders who would benefit. The White Paper concludes with this identification of options for stakeholders to consider in determining the desired robustness of the Transportation Framework and how to allocate costs.

Uncertainty and risk inhibits buy in by Framework stakeholders. Consequently, reducing uncertainty and risk is a primary challenge. Meeting this challenge with the goal of achieving stakeholder confidence and support will require agreement on:

- A clear articulation of stakeholder business needs and the corresponding Transportation Framework functionality.
- Feasible and achievable cost, time, and overall resource estimates.

Glossary of Acronyms

AHTD	Arkansas Highway and Transportation Department
ArcIMS	ESRI Arc Internet Mapping System
BLM	Bureau of Land Management
BMS	Bridge Management Systems
CADD	Computer Aided Drafting and Design
DLG	Digital Line Graph
DOT	Department of Transportation
DOQQ	Digital Orthophoto Quarter Quads
E911	Emergency Dispatch Organizations
ESRI	Environmental Systems Research Institute
FGDC	Federal Geographic Data Committee
FHWA	Federal Highway Administration
GASB	Government Accounting Standards Board Statement
GeoStor	Arkansas GeoSpatial Clearinghouse
GDT	Geographic Data Technology
GIS	Geographic Information Systems
GPS	Global Positioning Systems
IMS	Intermodal Management System
INSAR	Interferometric Synthetic Aperture Radar
IRICC	Interorganizational Resource Information Coordinating Council
ITS	Intelligent Transportation Systems
KDOT	Kansas Department of Transportation
LIDAR	Light Detection and Ranging
Mn/DOT	Minnesota Department of Transportation
NavTech	Navigation Technologies, Inc.
NCHRP	National Cooperative Highway Research Program
NHS	National Highway System
NSDI	National Spatial Data Infrastructure
ODOT	Oregon Department of Transportation
PMS	Pavement Management Systems
PSRC	Puget Sound Regional Council
PWDs	Public Works Departments
REO	Regional Ecosystem Office
USFS	United States Forest Service
SDS	Spatial Data Standard
StratMap	Texas Strategic Mapping Program
TEA21	Transportation Equity Act for the 21st Century
UNETRANS	Unified Network Transportation
USGS	United States Geological Survey
PSRC	Puget Sound Regional Council
WISLR	Wisconsin Information System for Local Roads
WSDOT	Washington Department of Transportation

Introduction and Purpose

This white paper assesses alternative approaches and data sources for the development of a Transportation Framework for the state of Washington. The white paper includes the development of a scope of work for pilot projects that may be needed to explore and test options for building and maintaining a Transportation Framework.

The purpose of this white paper is to systematically re-examine transportation data sharing issues that have been discussed at length, and in a manner to foster final decisions and closure. In some cases, choices among alternatives may require more detailed analysis or pilot studies. The development of this document has benefited from discussion at the Interorganizational Resource Information Coordinating Council (IRICC) Roads Committee, which has led to a consensus document. This sixth and final version serves to draw the process to a close and recommends a twofold approach to the development of a Transportation Framework. It also recommends six pilot studies to examine remaining issues in more detail.

The development of this paper was guided in part by the Project Charter of the Transportation Framework, State of Washington. The Charter has these key objectives:

> *5.1. Identify and recruit partners to develop, maintain, and distribute the transportation Framework and Framework data that meets a set of business and analytical needs defined by the partners and users.*
> *5.2. Develop a transportation Framework data model and standards based on business and analytical needs for the data, technology available to implement the model, and the ability to provide and maintain the data over time.*
> *5.3. Define and implement institutional arrangements to facilitate data collection and maintenance partnerships, and to make the data accessible at the least cost with the least restrictions on use.*
> *5.4. Implement interactive platform independent software, database, and processes to support integration of data received from data providers, maintenance of data by data stewards, and data accessibility by partners and the general public.*

This paper is supportive primarily of Objectives 5.1 and 5.2, with attention given to approaches to fulfill objectives 5.3 and 5.4. In addition, the Charter identifies critical success factors. This white paper seeks to achieve the commonality called for in factor 8.4:

> *8.4. Define a data model that partners agree meets their needs.*
> *Identify business needs and functional requirements, and define the data needed to support them. Examine existing data models. Seek consensus agreement on the data model. Partners commit to achieving consensus. Provide frequent and on-going communication of progress and decisions to partner organizations.*

The Scope of the Transportation Framework

It is anticipated that the Transportation Framework will have two purposes. First, the Framework can be considered a set of coordinated map layers comprising point, line, and area objects representing the location and extent of transportation features that are **complete, consistent, and current**. This part of the Transportation Framework provides a source of "best available" linework and attribute data that would be updated periodically, probably on an annual basis. This representation would serve ***business needs*** of a **planning** type for a limited range of transportation and non-transportation organization stakeholder applications. It may also support a limited number of **operations** type applications, such as pathfinding for rerouting and permitting. Individual users can assess it for fitness to their application. In many instances the Transportation Framework may need augmentation for specific applications. For example, many business needs, such as transportation planning, congestion management, etc., require at least a bi-directional centerline if not dual carriageways or even individual lanes, either in the basic geometry or by attribution. These needs may be too specific or time sensitive to include within general use data for which the Framework is responsible.

The second purpose of the Transportation Framework scope is to facilitate updates. This would entail a **Clearinghouse of new or modified road features** that is collected in the form of transactions. These transactions would be derived from construction projects undertaken by or on behalf of transportation organizations. They are then accumulated in the Clearinghouse, and used to update the Transportation Framework's complete, consistent, and current representation of the transportation system. In addition, organizations that maintain their own transportation databases could select updates for transportation features deposited by all transportation organizations for their region of interest.

This twofold approach satisfies the need to facilitate updating the best available data, while at the same time making more detailed data available pertaining to new and modified transportation features. This will support those who need updates of more detailed content and greater spatial and temporal accuracy.

The challenge to this twofold approach is to create incentives and/or mandates to report new and modified transportation feature data to the Clearinghouse on a transactional basis. In part this can be done by providing guidance on the proper form of formatting and reporting of these changes.

State Framework Review

This section reviews other efforts at creating state Transportation Frameworks, some of which are also aimed at adopting and/or testing the Federal Geographic Data Committee (FGDC) transportation identification standard (FGDC, 2000). Two approaches are noted. The first represents state Departments of Transportation (DOTs) which build statewide Geographic Information Systems (GIS) databases of

all roads for internal reasons. These can be seen as indirect attempts to create a statewide Transportation Framework. The second approach is to build a comprehensive Transportation Layer within the context of a statewide FGDC-inspired Framework. Both of these efforts are reviewed here.

Several states have embarked on developing statewide GIS databases of all roads. The following summarizes some key points from three states: Minnesota, Wisconsin, and Arizona. These states are leading the way because of their early start in tackling the work. They are starting from existing mainframe highway inventory and mapping applications, while enhancing and converting to a GIS application.

Arizona DOT completed a road centerline map database in 1975. The Centerline update project is largely a bulk integration of highway data, county by county. The update process consists of conflating data from various sources and the addition of linear referencing and addresses. A transactional updating system that will rely on segment IDs that are being assigned is envisioned after completion of the project. The Wisconsin Information System for Local Roads (WISLR) is a redesign of a 25-year-old local roads database used for roadway inventory and payment of general transportation aids to local governments. Limitations of the prior system are being addressed in the redesign and linear referencing is being added. The emphasis is focused on rebuilding the database, and its maintenance still needs to be addressed systematically. Minnesota DOT has embarked on a system development to build a digital unified base map of all roads in Minnesota. The Minnesota DOT effort replaces the existing 30-year-old mainframe system and it includes railroads, navigable waterways, and airports as well as highways. Again, there does not appear to have been much attention to update and maintenance issues and concerns. The Wisconsin and Minnesota efforts are both quite expensive upgrades of mainframe files to GIS applications to support state aid to local road programs.

Texas is developing the Texas Strategic Mapping Program (StratMap) to compile what it terms "mission-critical" GIS Framework data, including transportation, for the entire state. An integral part of the StratMap objective is the "open exchange of information between agencies, open access to non-sensitive government information, and private sector value-added opportunities." Phase 1, the compilation of the initial transportation Framework by vehicle Global Positioning Systems (GPS), was completed in August 2001. Data are being compiled using an object-oriented model, meeting FGDC standards for road identification. The next phase will include "maintenance, production, and enhancement of those data layers… transportation and boundaries will be maintained with current data as it becomes available." The Framework is currently available as an 11-county subset on CD-ROM.

Both Vermont and Montana have made significant progress in testing Framework implementation using FGDC schema for identification. Vermont has recently completed its pilot project. Montana began a similar FGDC Framework review pilot titled "A Collaborative Multi-jurisdictional Approach to Building a Geospatial Ground Transportation Framework Database for Montana."

The Intergraph Corporation conducted a study for the Kansas Department of Transportation (KDOT),"NSDI Transportation Data Model Impacts," completed in

April 2000. This was not an attempt to test or build a Framework, but a test of making the KDOT transportation database compliant with the FGDC model and metadata standards.

A larger number of states now maintain statewide GIS clearinghouses as nodes of the National Spatial Data Infrastructure (NSDI) National Geospatial Data Clearinghouse. These include Alabama, Alaska, Georgia, Iowa and Nebraska.

Arkansas has successfully created GeoStor, "an on-line data delivery system that allows the user seamless access to digital map data (GeoData) of any area in Arkansas with no subscription fee." Efforts are being made to link the GeoStor project with a state Transportation Framework in cooperation with Arkansas Highway and Transportation Department (AHTD). AHTD has begun its own Framework equivalent project, the Arkansas Centerline File project. Information will be captured utilizing GPS techniques, digitizing from second generation Digital Orthophoto Quarter-Quads (DOQQ), and/or warping and attributing AHTD centerline files to match the second generation DOQQs.

Georgia has set out to compile a Transportation Framework to use in constructing the "Georgia Spatial Data Infrastructure" state equivalent of the NSDI. The Framework website reports that the transportation database is complete and accessible, but provides no other documentation.

Kentucky has recently adopted an enterprise architecture perspective and has developed its own spatial data standard, an integrated model of multi-thematic data content standards. The spatial data standard represents an implementation of the Federal Geographic Data Committee geospatial data content standards and meets data sharing requirements of the NSDI. Beyond this, Kentucky DOT is creating a complete street Centerline file using GPS.

Utah has made an effort to develop the Utah Framework Implementation Plan, based on the seven FGDC NSDI Framework layers. The transportation Framework effort is adhering to the FGDC standards and data model. Utah is also involved in a transportation pilot study testing the USGS National Map. The only other transportation pilot study is the Washington-Idaho National Map pilot, which includes Spokane and Pend Oreille counties in Washington, and Kootenai and Bonner counties in Idaho.

The Washington-Idaho National Map pilot will explicitly attempt to build up the Framework map from as many local sources (city, county, state and Forest Service) as possible. Any gaps in available data will be filled in with data purchased from a vendor, GDT. Datasharing partnership agreements and incentives to participate are seen as key organizational elements to be tested. An ArcIMS NSDI clearinghouse node is being considered as the data server for the pilot.

In summary, these state efforts provide guidance on the initial building of a comprehensive and complete statewide transportation layer. They are very expensive to build, but in spite of this, little attention as of yet has been given to complex and costly issues of updating. The second approach, that of attempting to test compiling

data from numerous sources following the FGDC Road Identification schema, is moving ahead more slowly, as state GICs work to tackle both technical and organizational issues that so far have hampered Framework construction. From this review we can not yet deem either approach as being successful in meeting objectives.

In addition to the state framework efforts, the U.S. Bureau of the Census MAF/TIGER Modernization Study (Booz, Allen and Hamilton, 2000) proposes a system to update and maintain TIGER, an important source of data for many street and road centerline databases. An objective of the 21st Century MAF/TIGER Enhancements initiative is to correctly locate every street and other map feature in the TIGER, each MAF (Master Address File) address, and implement an effective automated feature change detection methodology. This program will provide a highly accurate and up-to-date resource that will be available to support other core activities that rely on address list information.

Business Needs

Business needs of users of transportation data are examined to determine the content, structure, and spatial and attribute accuracy requirements for the Transportation Framework. The challenge is to determine how many and which needs to accommodate in a single representation of the transportation system. Building a robust multi-purpose representation would be costly and difficult and would demand frequent updates. On the other hand, a simpler representation might not serve enough needs to be justifiable.

The purpose of this assessment of business needs is to determine the content and accuracy requirements of the Transportation Framework. Assuming a common representation cannot meet all business needs, the Transportation Framework needs to include a mechanism to aid and foster updates or data sharing among those who maintain their own transportation databases.

All organizations that have GIS-T applications do so in support of some combination of **planning, management, and operations** needs. Generally, the business needs of planning can usually be met with spatial data of low or medium spatial and temporal accuracy. Another generalization is that the business needs of non-transportation organizations require less accurate spatial and temporal transportation data than do transportation organizations. These conclusions follow from an assessment of the business needs and applications discussed below.

Although the business needs supported by the Transportation Framework should be limited to requirements that are inter-organizational in nature, intra-organizational data sharing may be a stronger motivation than inter-organizational data sharing objectives. Many organizations have internal stovepipe systems that could benefit from better sharing of data. Improving data sharing within the organization would thereby foster inter-organizational data sharing capacity.

A preliminary examination of business needs within WSDOT exemplifies opportunities for data sharing within and outside of the Transportation Framework. The business needs of WSDOT fall in the following categories:

- The need to relate state roadway data to other layers, such as land ownership, local roads, wetlands, streams, land use and land cover, utilities, and sensitive environmental and cultural areas.
- The need for a detailed inventory of infrastructure on state roads.
- The need for a complete GIS representation of all roads in the state in a form to support routing that includes functional and jurisdictional classification, surface type, status, and height, weight, and turn restrictions.

Meeting these internal business needs requires sharing of data within WSDOT and externally with others. Achieving the internal data sharing will make the external data sharing easier and more effective. WSDOT will need to address which business needs can be derived from Framework data, and which will need more detailed content or more frequent updates than can be provided by the Framework, and thereby maintained outside of the Framework.

WSDOT should be able to take advantage of the Framework in satisfying its business needs. They need to relate transportation layers to other Framework layers. They need a comprehensive GIS-based infrastructure inventory system as well as a complete, consistent, and current representation of roads suitable for routing applications.

The requirements of several statewide or regional applications for transportation data are examined to identify common transportation data elements and spatial and temporal requirements to include in the Transportation Framework. These applications are emergency management, infrastructure management, freight mobility, and salmon enhancement. All four are illustrative of the growing and diverse applications of transportation data.

Emergency Management Business Needs

Emergency Management is subdivided into *disaster planning* and *emergency response*. Disaster planning is an important form of contingency planning that deals with evacuation routing and rerouting around closed facilities. Contingency planning does not require a high level of spatial and temporal accuracy. On the other hand, emergency response has a higher need for current data and has a higher need for spatial accuracy to snap GPS-derived positions to the correct piece of road. For emergency response, temporal accuracy is the highest requirement. The most recent streets and corresponding addresses are required for proper emergency call address matching and routing. Spatial accuracy is required for disaster planning, due to the need to assess road and bridge impacts from floods, fires, and earthquakes. The temporal accuracy requirements for contingency planning are low.

Disaster planning makes increasing use of GIS as a means of quickly integrating and sharing data among agencies. Road centerline files help determine evacuation routes

and answer spatial questions or queries, such as: What roads are subject to flooding? Which routes are already designated emergency routes (for plowing, etc)? What are evacuation times of main/alternative routes? Where are bridges (possibly impassable) located? What roads are affected by disaster? Are they totally impassable? What alternative routes are available?

This distinction between business needs of planning and operations is crucial. For example, disaster planning is a planning business need of emergency management, while emergency response is an operational business need, and there are distinct differences in their spatial and temporal accuracy requirements. A common Transportation Framework would serve the needs of disaster planning, but the needs of emergency response would require more currency, or temporal accuracy than can be supported by the Transportation Framework.

Homeland security has become a major issue in the arena of emergency management. Homeland security encompasses both disaster planning and emergency response in the event of a disaster or emergency. The emergency response component of homeland security would in all likelihood require a specialized database, to handle specific operational needs of homeland security. The representation in the Transportation Framework used for contingency planning would be a good starting point.

Infrastructure Management Business Needs

The business needs of infrastructure management are complex. Infrastructure management is an organizing concept that pertains to organizations responsible for planning, construction, maintenance, and operation of infrastructure, such as departments of transportation and public works. They tend to require significant levels of inter-organizational coordination, and are thereby candidates for data sharing via the Transportation Framework.

The lifecycle management concept used in infrastructure management consists of the functions of planning, construction, maintenance, and operations. These categories are useful in assessing spatial and temporal accuracy requirements. These can be used to address many applications that fall under the heading of infrastructure management. These are examined in detail: new Government Accounting Standards Board Statement (GASB) 34 reporting requirements for asset management, road pricing, and freight mobility.

Asset Management/GASB 34. The recently released GASB 34 requirements reiterate and reinforce the business needs requirements of asset data management. A good working definition comes from the FHWA Asset Management primer: "Asset management is a systematic process of maintaining, upgrading, and operating physical assets cost-effectively. It combines engineering principles with sound business practices and economic theory, and it provides tools to facilitate a more organized, logical approach to decision-making" (FHWA, 1999). Properly designed and implemented asset management systems can bridge the stovepipe problem of current individual bridge management systems (BMS) and pavement management

systems (PMS). This in turn inhibits the sharing of data that the Transportation Framework, and this paper, is attempting to help address.

Underlying the business needs of Asset Management is the "economic assessment of trade-offs between alternative improvements and investment strategies from the ***network-or system-level*** perspective" (FHWA, 1999). Some of the basic business needs identified by the FHWA include: inventory of assets (physical and human resources); valuation of assets; quantitative condition and performance measures; and performance-prediction capabilities. An effective Asset Management system, making use of the Framework, has the potential to strengthen the now-tenuous link between the transportation plan and actual programming and resource allocation decisions.

GASB 34 allows government agencies to get around the depreciation requirement for infrastructure assets if these assets are managed using an asset management system, and if the infrastructure is being preserved at or above a predetermined condition level. According to GASB 34, the asset management system should:

- Have an up-to-date inventory of assets;
- Perform condition assessment of the infrastructure assets at least once every 3 years, and summarize the results using a measurement scale; and
- Estimate the annual amount required to maintain and preserve the infrastructure assets at the condition level originally established for those assets (FHWA 1999).

Asset Management requires an inventory-based GIS where assets are referenced linearly to the transportation system. The detail of assets is beyond the scope of what should be included in the Transportation Framework, but the underlying geometry of the transportation system should come from the Transportation Framework.

Road Pricing. The financing of highways is expected to move from a gas tax-based system to a mileage-based system. A mileage-based system could be extended to differentiate charges by road segment and time of day. However, differential charges by location and time of day would require vehicle-tracking systems that link to digital road map databases that provide segment charge rates. Spatial accuracy sufficient to snap to the correct segment and temporal accuracy to reflect all roads in use would be needed.

The spatial accuracy issue is confounded by two considerations. One is that tracking depends on following a sequence of positions. When one or more GPS data points are wrong due to errors in positioning from passing under overpasses or past high-rise buildings that interrupt signals from satellites, the vehicle appears to leap off one road onto another and back again. Tests of relative distance are needed to determine if a point is too far away from the last position to be possible. The second problem is that the spatial accuracy requirement is dependent on the geography of the road network. In areas of greater density, with roads close together and many intersections, much greater accuracy is needed to place a vehicle on the correct segment. This is a particular problem on important segments such as freeways due to the proximity of frontage roads, ramps, and over- and under-passing streets. Consequently, transponder reader instrumentation of selected facilities, such as major highways

where differential charges are imposed, may be preferable to sole reliance on vehicle tracking.

If the above-mentioned problems associated with vehicle tracking are solved, the Transportation Framework, with sufficient spatial and temporal accuracy, could provide the basis for the digital road map database for highway finance systems of the future. In addition, if the Transportation Framework includes attribution of jurisdictional responsibility, the mileage summaries by jurisdiction can be produced.

Freight mobility. Freight mobility has emerged under TEA-21 as a major transportation planning requirement. Safe and speedy transfer and transport of goods is vital to the port-based economies of the Pacific Northwest. Freight is increasingly facing delays as urban roadway congestion increases. Business need attributes include: congestion levels, roadway condition, low clearances, bridge weight restrictions, and lane restrictions. These may require more detail than road centerlines will permit.

The freight sector faces three broad areas of improvement with respect to business needs (Paulson, 2001): institutional development, including developing multi-jurisdictional freight institutional approaches; leveraging information technology to optimize system performance; and infrastructure investment.

A "last mile" syndrome also increasingly hampers freight mobility. Short intermodal connectors that link the National Highway System (NHS) to major intermodal transfer facilities represent this last mile. These predominantly local urban streets are hampered by pavement deficiencies twice the average of other non-NHS roads (Paulson, 2001). Modeling both freight and passenger travel requires these road segments.

An assessment of freight mobility indicates that planning business needs could be accommodated by low- or medium-accuracy spatial and temporal data, but would require augmentation with more attribute accuracy (clearances and restrictions) than would likely be part of a common Transportation Framework. The overweight and oversize permitting (operations) process would likely require more temporal accuracy than would be provided in a common Transportation Framework in terms of restrictions associated with construction or weather. Nevertheless, if a state DOT were to host the Transportation Framework, enhancement and support for overweight and oversized permitting may be desired.

Salmon enhancement Business Needs

Salmon enhancement planning has become one of the pivotal social, economic and environmental issues for the Pacific Northwest region. For the ODOT Salmon Recovery Initiative, ODOT has completed a culvert inventory over two years. Each culvert has been categorized by whether or not it meets fish-passage requirements.

For salmon-enhancement planning the IRICC Roads committee has developed a roads database design in the process of identifying the roads spatial data set business

requirements for inclusion in the Regional Ecosystem Office (REO) regional Framework clearinghouse for spatial data set management and coordination. This database design is included in Appendix A. The salmon enhancement planning business requirements include ecosystem assessments that specify road and hydro relations to determine locations and types of bridges and culverts, cuts and fills near streams, and that identify road construction projects that produce sediment to the hydro system. Very high positional or spatial accuracy is needed to properly locate and align the road and hydro layers.

The planning business needs of salmon enhancement can be accommodated by medium accuracy temporal data, but will require a level of spatial accuracy that is consistent with hydro data. Salmon enhancement planning will also require the integration of road and bridge attribute data from a number of transportation organizations.

Table 1 displays the applications discussed above and identifies the spatial and temporal accuracy requirements in general: low, medium and high.

Table 1
Framework Business Needs

Emergency Management

	Planning	***Management***	***Operations***
Business Need	Disaster Planning	Response Coordination & Reporting (C & R)	Emergency Dispatch
Spatial Accuracy	Medium	Low	Med/High House/Highway
Temporal Accuracy	Low	Low	High
Data Model	Boundary, Bi-Directional Flow Network	Thematic Map	Bi-Directional Flow Network
Attributes	Bridge Height & Weight Restrictions	Functional and Jurisdiction Classes	Street Address Ranges

Infrastructure Management

	Planning	***Construction***	***Maintenance***	***Operation***
Business Need	Planning Asset Mgmt (GASB)		Emergency Dispatch	Road Pricing
Spatial Accuracy*	Medium	High (engineering)	Med/High House/Highway	Med/High (Veh on ramp)
Temporal	Low	Medium	High	Medium

Accuracy*				
Data Model	Boundary, Flow Network	Engineering Maps	Flow Network	Flow Network
Attributes	Bridge Height & Weight Restrictions	Owner/Contact for transportation segment	Street Address Ranges on Hwys.	Road Closure; Impedance
File Maintenance	Adding Planned, Retiring Status	Add New Features	Change Attributes	Update Road Closure; Impedances

*See Table 2 for definitions of Low, Medium, and High

Freight Mobility

	Planning	***Management***	***Operations***
Business Need	Intermodal Connections	Intermodal Mgmt System (IMS); C & R	Congestion monitoring; Routing
Spatial Accuracy	Low	Low	Medium
Temporal Accuracy	Medium	Medium	High
Data Model	Flow Network; Multimodal O/Destination	Thematic Map	Flow Network
Attributes	Link, Depot Capacity	Flows and Terminal Activity	Clearances and Restrictions
File Maintenance			

Salmon Enhancement/Fish Passage

	Planning	***Management***	***Operations***
Business Need	Ecosystem Assessments	Interagency coordination	Culvert Replacement
Spatial Accuracy	High	Medium	High
Temporal Accuracy	Low	Low	Low
Data Model	Flow Network;	Thematic Map	Flow Network
Attributes	Bridge/Culvert type	Bridge/Culvert type	Bridge/Culvert type
File Maintenance			

NCHRP Functional Requirements

The functional requirements identified in the National Cooperative Highway Research Program (NCHRP) 20-27(3) project on GIS data models for transportation were also examined. These are the most demanding transportation requirements.

The NCHRP 20-27(3) project is concerned with Intelligent Transportation Systems (ITS) functional requirement needs. Basic ITS requirements include vehicle dispatch,

traffic information and management, incident management, and transit fleet management. Functional requirements include spatial/temporal referencing methods and a referencing system/datum. The method would include the use of four-dimensional time-space, and the system itself would need to accommodate a *temporal* datum.

Examination of the NCHRP functional requirements did not prove too helpful as the focus was on temporal issues that are more important to ITS applications than to the first-generation Transportation Framework. The ITS applications have temporal requirements that are beyond those required by most of the agencies involved in constructing the Transportation Framework. It is expected that the temporal requirements for most of these common applications of Transportation Framework data will be less demanding than advanced transportation applications, such as ITS. This exemplifies that update frequency differs among applications, as do spatial accuracy requirements. Consequently, the important issue is to determine the common needs of state Framework stakeholders for transportation data, in terms of data model, attributes, spatial accuracy and update frequency.

The initial Transportation Framework may support only a subset of the identified business needs. Time and cost constraints may preclude building the most robust Transportation Framework. Similarly, timelines to upgrade legacy data files to more recent versions of software and data models, such as ArcGIS and ESRI's object-oriented data model for transportation, UNETRANS, is thought by many as the opportunity to reorganize their transportation data. In the meantime, there may be reason to focus on the implementation of a less robust Transportation Framework. However, ArcGIS and UNETRANS are not providing a clear and unambiguous migration path. For backward compatibility reasons, ArcGIS is still a geometry-centric solution and additional tools are needed to support development of logical systems with multiple cartographic and network representations.

Spatial and Temporal Accuracy

The Transportation Framework must be consistent in spatial and temporal accuracy with other statewide Framework data and FGDC layers (Administrative Boundaries, Hydrography, Cadastral, Ortho imagery, Elevation, and Geodetic Control).

Spatial Accuracy: Spatial Accuracy needs will vary, according to business needs. Although it is desirable to find the least amount of accuracy necessary to the Framework, a flexible model that accepts (and maintains metadata for) ***data of varying accuracy is desired***.

Temporal accuracy and currency: Temporal accuracy in the context of the Transportation Framework deals with the frequency and method of update. Table 2 provides a first approximation of accuracy requirements for the Transportation Framework that takes into consideration consistency with other Framework layers. Differing requirements in urban and rural areas is also recognized in Table 2.

Table 2
Accuracy Requirements

Type of Region	*Metropolitan*			*Non-Metropolitan*		
Accuracy Level	*High*	*Medium*	*Low*	*High*	*Medium*	*Low*
Source Scale	1:1000	1:10,000	1:24,000	1:5000	1:24,000	1:100,000
Positional Accuracy (ft)	1 -5'	20'	40'	10'	40'	100'
Temporal Accuracy (update frequency)	less than 1 minute	1 - 7 days	3 months	1 - 5 minutes	2 -14 days	12 months
Linear Accuracy (ft)	1'	5 - 10'	50'	5 - 10'	50'	250'
Attribute Detail (# of attributes per segment)	100+	10 - 100	1 - 10	100+	10 - 100	1 - 10

Table 3 identifies the source material and the range of spatial accuracy that constitute low, medium, and high spatial accuracy.

Table 3
Spatial Accuracy Requirements Classifications

	Spatial Accuracy	
Classification	*Range of Spatial Accuracy*	*Source Material*
Low	1:24,000-1:100,000	Spatial Imagery USGS
Medium	1:10,000-1:24,000	USGS; High resolution imagery; GPS
High	1:1000- 1:5000	Engineering maps, High resolution imagery, GPS

Conclusions from the Assessment of Business Needs

The business needs of GIS applications in the areas of natural resource management, infrastructure management, emergency management, and services management applications were assessed. We conclude that the Transportation Framework should focus on supporting **planning** functions initially, with very limited support for the needs of **operations**. In a longer timeframe, a more robust Transportation Framework, one having greater spatial and temporal accuracy and more detailed attribution, could support more management and operations functions. But initially the requirements and standards for the Transportation Framework are translated to spatial data set and GIS functional requirements that support planning functions. These requirements are both a consistent spatial and temporal accuracy across Framework layers, and a consistent representation of transportation across

organizations. The initial requirements for the Transportation Framework relate to other Framework layers and to other organizations. The requirement of consistency with other statewide Framework layers (Administrative Boundaries, Hydrography, Cadastral, Ortho imagery, Elevation, and Geodetic Control) includes:

- Administrative boundaries that fall on streets should align with the Transportation Framework's representation of those streets.
- Hydrography and Transportation should relate correctly, i.e. the stream on the correct side of the road and the steam crossings at the correct river and road milepoints.
- Centerline representations of transportation features should fall within rights-of-way of Cadastral layers.
- Centerline representations of transportation features should relate correctly to Ortho imagery.
- The elevation attributes of transportation features should be consistent with the Elevation layer and topographic maps generated from it.
- The temporal currency of transportation features should be as or more current than the other FGDC layers.
- The Transportation Framework should support routing applications for contingency planning.

The requirement of a consistent representation of the Transportation Layer across organizations requires that organizations agree on fundamental elements of transportation in order to exchange data. This consists of the following:

- Criteria for segmenting and identifying roads, i.e. the need to define a transportation feature to facilitate inclusion, identification and exchange of data.
- Consensus on treating transportation features and their intersections as logical objects that can be represented at larger scales as divided roadways with details of ramps and lanes.
- Consensus on some minimum level of network topology and link and node attribution of restrictions for simple routing.
- Consensus on the frequency of updating the Transportation Framework.
- Consensus on methods of identifying additions, changes, and deletions of transportation features and sharing updates.
- Consensus on the linear referencing methods to locate attributes along transportation features.
- Consensus on selected attributes of transportation features that are needed by most organizations.

It is important that all Framework participants acknowledge that the Transportation Framework is not intended to be a replacement for their transportation databases, so it does not have to, nor should it, contain the detail or the robustness to satisfy all their applications. Yet their databases may be derived from the Transportation Framework and should be updated from transactions from the Clearinghouse of new or modified transportation features.

The Transportation Framework intends to provide a **single** and **consistent** representation of the transportation system that is both **complete** and **current**. **Single** means a common definition of features in the Transportation Framework and a core set of attributes about the features. **Consistent** means a known level of spatial and temporal accuracy with proven updating mechanisms. The result is consistency in spatial representation and temporal currency. Organizations who share data via the Transportation Framework help assure consistency of representation and accuracy.

Those organizations that contribute data to the Transportation Framework are assured that other organizations have access to the most current and accurate inter-organizational data. Those organizations that access data from the Transportation Framework are likewise assured that they have access to the most current and accurate inter-organizationally planning data that is available. Similarly, within organizations, there is a need to share data to avoid the problems of stovepipe systems that duplicate basic data and lead to inconsistent representations with varying degrees of spatial and temporal accuracy.

The main objective is to reduce the number of redundant project-level databases that decay over time and quickly lose value. This is accomplished by substituting a Transportation Framework that is easy to access and is responsive to the varied planning-level business needs of the numerous organizations with pieces of the transportation puzzle. Consequently, the Transportation Framework fosters use of the best available data, and relies on data sharing mechanisms to maintain its currency.

A Transportation Framework incorporating all modes may be difficult to compile. Existing statewide digital representations of rail, pipeline, waterway, airports, and public transportation systems are likely to exist at small scales only (1:24,000 or 1:100,000), that would not spatially register with the more detailed roads layer. They would have to be horizontally integrated, and the lack of temporal consistency would create a new problem. Consequently, creating a ***separate roads layer*** is the advisable direction, while developing separate layers for other-modes at a smaller scale. The ***other-modes layers*** would include the systems mentioned above: rail, pipeline, waterway, airports and public transportation systems**.** Separate modal layers will require modal transfer points on each to relate them. This is an interim solution before attempting development of an integrated all-modes Transportation Framework that would be spatially and temporally consistent.

Treating the ***other-modes*** as separate layers relieves the Transportation Framework of being held initially to an overly high or robust standard.. These other layers would conceivably handle most anticipated routine applications. One application that may not be handled well, however, would be salmon enhancement, in which case recompilation may be needed to handle rail and water intersections in salmon enhancement study areas. Consequently, it may be desirable to integrate roads and rail modes at the outset to handle rail-crossing applications and to ensure correct topology and spatial registration.

We are unable to conclude which is the preferred method of compiling the complete, consistent and current representation of the Transportation Framework (Roads)[1]. Three pilot studies are proposed to assess the different methods of compiling the Transportation Framework (Roads). One way is to have a single contractor or agency compile it. Another way is have each transportation organization add and fit their data. The third way is to hire a road database vendor to abstract or enhance their product to meet Transportation Framework requirements, and to maintain it.

Regardless of which approach is chosen (commercial or primary sources) the road vector data will need to be displayed on digital orthophoto imagery for validation. Validating means a comparison of the road vector data to the image for completeness (exists in both) and spatial registration (moving the vector data to match the orthophoto image, or "ground truth"). This should be done preferably at 1:12,000 scale, using the most recent ortho-rectified imagery available. The increasing availability of high-resolution, remotely sensed topography using Light Detection and Ranging (LIDAR) and/or INSAR technologies is also useful (see www.pugetsoundlidar.org for examples).

Rationale for Transportation Framework (Roads)

The process for deciding on the structure, content, and detail of the Transportation Framework has been long and arduous. There has been constant tension between keeping the Framework basic or making it more robust. The argument for simplicity is driven by natural resource applications that merely need "best available" linework for roads to serve as reference data. Yet, when the business needs of user organizations are examined more closely, they often need more robust, intelligent road data to handle routing questions, road ownership or responsibility, surface type, status (planned, under construction, open/closed, retired), bridge/culvert structures, etc. Incorporating these attributes into the roads database increases the importance of updating the data. Consequently, it is difficult to keep the Framework basic.

Meeting the more demanding business needs of transportation organizations (agencies that own and maintain roads, such as departments of transportation, public works, and U.S. Forest service and timber companies) requires even more data. The routing of overweight/oversize vehicles requires weight/height restrictions, and road maintenance requires a detailed inventory of roadway infrastructure.

This tension between simplicity and robustness resulted in the realization that a complete, consistent and current representation of roads is needed, but the Transportation Framework cannot meet all business needs for road data. Yet, the Framework should play a major role in collecting data concerning new or modified roads that will enable updating and improving the complete representation of roads. This led to the notion of a clearinghouse for data on new and modified roads that would serve to update and improve the "best available" data on roads, and to serve as a resource to others who maintain their own roads database.

[1] The remainder of the report addresses Roads only.

This learning process led to the establishment of the following criteria and design principles for the Transportation Framework (Roads):

- Compile "best available" data from existing imagery and GIS resources to create a complete, consistent, and current roadway system. Attribute it minimally to support simple routing applications.
- Enable its gradual improvement in spatial accuracy and correspondence with other layers on an as-needed, ad-hoc basis by means of a check-out/check-in process for regions undergoing detailed study.
- Enable the addition of content detail and spatial accuracy from engineering CADD data and inventory databases. This requires that the Transportation Framework includes a roadway identification schema and linear referencing.
- Establish an explicit periodic updating process to keep the complete representation of the road system current.
- Capture data when roads are created or modified. Begin the capture of these data on a **day-forward** basis as **transactions** as the best means to update the complete representation of the road system.
- Create a **clearinghouse** of these transactions from which other road database users can query and select data to maintain and update their own organizations' data.
- Create incentives, mandates, guidance, and technical assistance to transportation organizations to foster the reporting of metadata relating to all of the activities outlined above.

The Transportation Framework Concept

Figure 1 is an illustration of the component parts of the Transportation Framework (Roads) and its inputs and outputs. There are two major components of the Transportation Framework (Roads). The first, labeled A, is a complete, consistent, and current representation of Roads, and the second, labeled B, is a Clearinghouse of new or changed Roads. The diagram illustrates the compiling or building from GIS source material to create the initial Roads database. After this initial build process, the database would be updated periodically from the data collected in the interim by the Clearinghouse of new transportation features. In addition, there would be checkout procedures for more extensive and complete upgrading for selected regions as warranted. This complete representation of the Road system would be of use for GIS analysis by organizations who wish to use road data, but who do not want to maintain a roads database. On the other hand, there are organizations that need to maintain one or more roads databases for their region of interest, but who find it difficult to obtain current data from other organizations that are responsible for maintaining roads within the same region. After implementation of this Transportation Framework concept, these organizations would query the Clearinghouse for jurisdictions within their region of interest, for Transportation Feature types of interest, and for a time period of interest. This more direct way of obtaining data on roads that are new or have undergone change would increase efficiency and effectiveness.

Because consensus must first be reached on assigning identifiers (NSDI framework transportation identification standard (FGDC, 1999)), updating of the "A" or "best available" data will at first occur using the industry-standard "shapefile" format developed by ESRI. This is a widely used and exchanged format across multiple GIS platforms, and hence will facilitate the initial periods of updating. These files are routinely exported and can be exchanged over the Internet as zipped files and fairly easily opened and integrated using standard GIS tools. This is meant as an interim measure awaiting the adoption of identifiers and transaction updating methods. This will meet the need for "simplicity" and ease in the initial maintenance of the Framework and the use of a Clearinghouse. (See Dueker and Butler, 2000 for a discussion of issues of definition and identification of transportation features). Also, Figure 1 illustrates an evolutionary process that starts with a project (PJ) that utilizes the Transportation Framework (A) and then evolves to a separate roads database to support an on-going operational program (PG) whose database needs more frequent updating. This program roads database then draws updates from the Clearinghouse (B). Alternatively, improved project database could be used in a check-out/check-in process to upgrade the Transportation Framework (Roads). This is represented by the arrow from PJ to the Check-out/Check-in Upgrade box in Figure 1. The diagram shows how transportation organizations input to the Clearinghouse for data about new or modified roads for which they are responsible. At the same time they are users of the Clearinghouse for data about new or modified roads that are maintained by others within their region of interest. Figure 2 illustrates this exchange of data among transportation organizations more clearly.

Figure 1. Building and Maintaining the Transportation Framework (Roads)

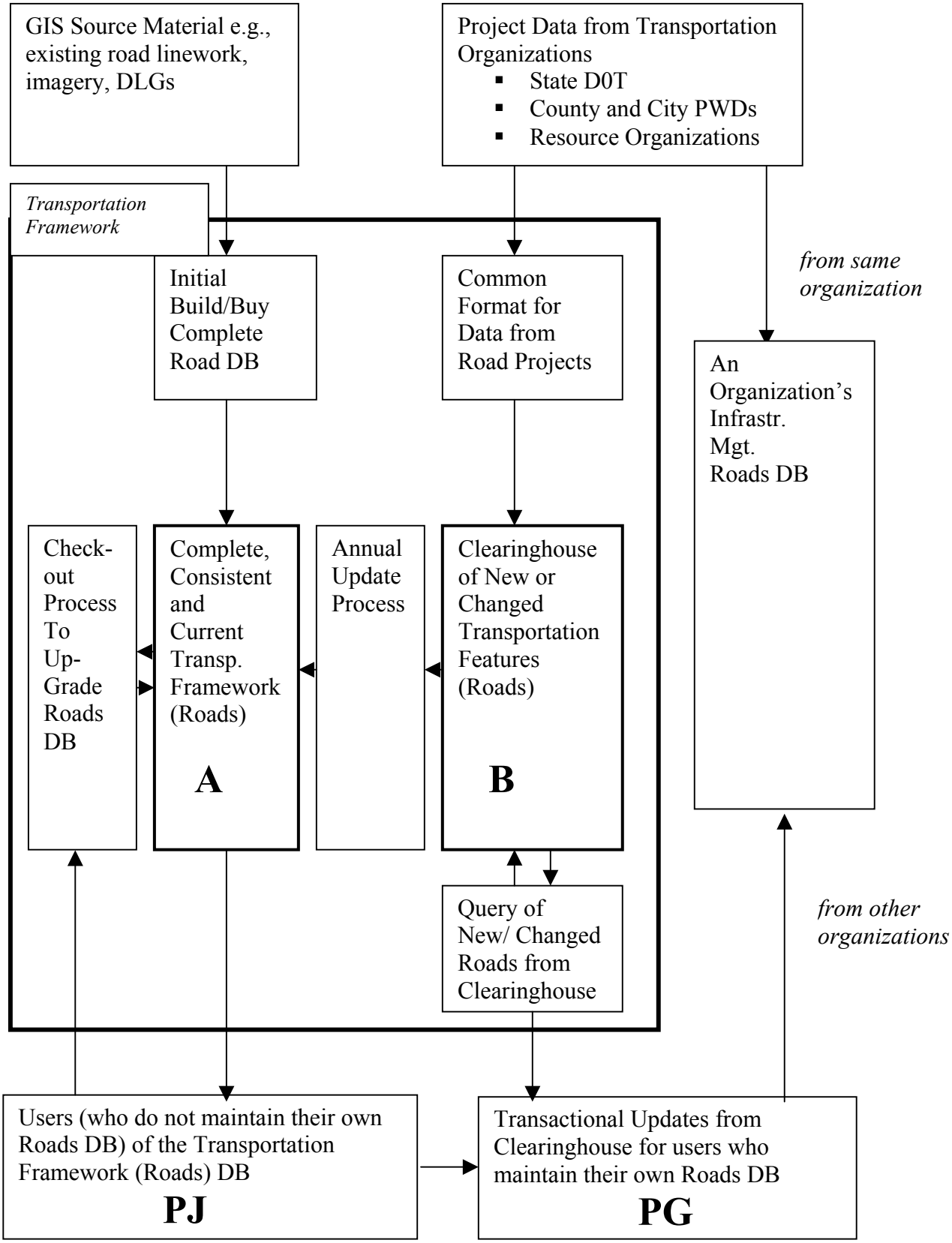
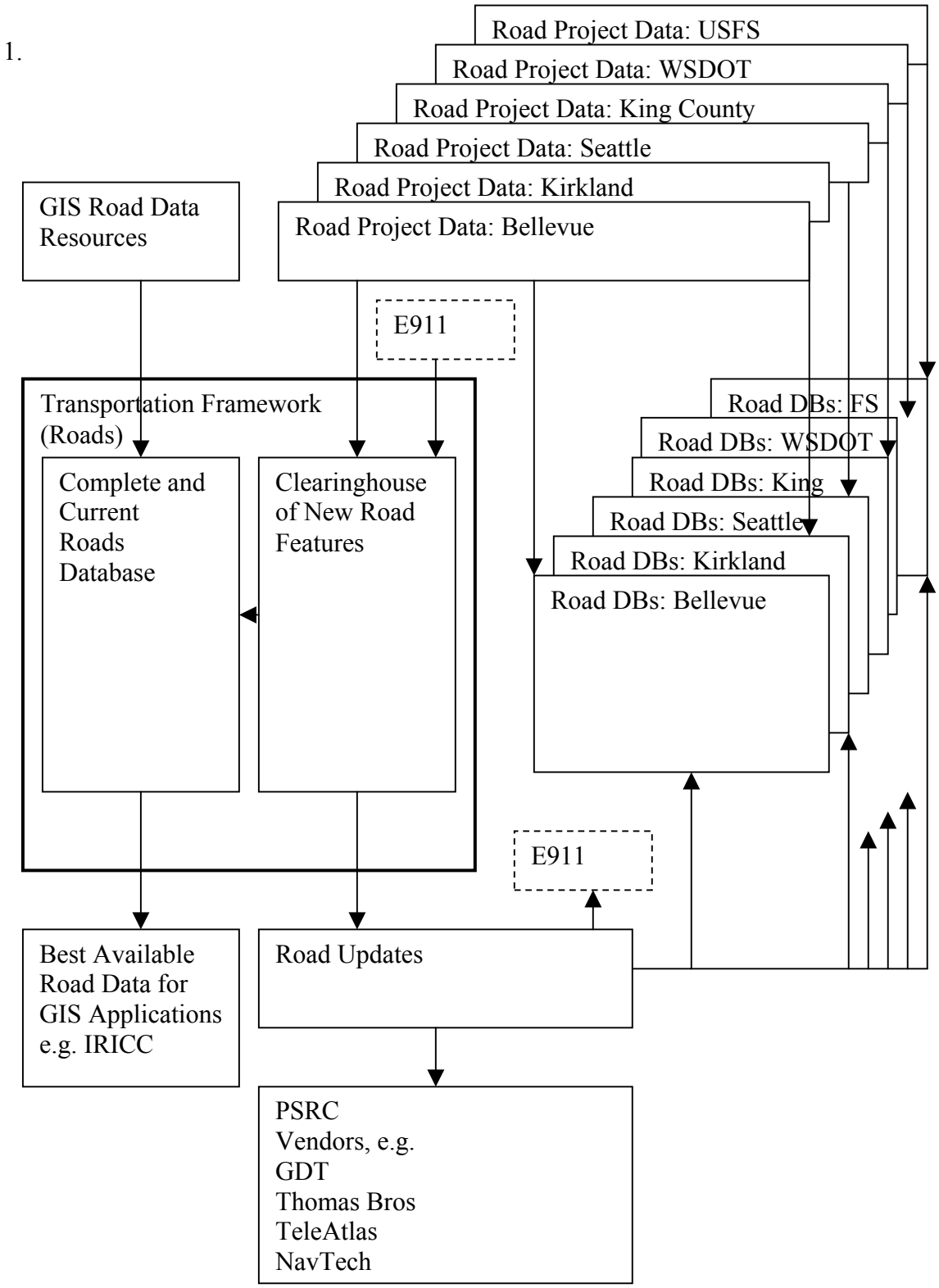


Figure 2 illustrates the user community for the Transportation Framework (Roads) by means of an example for King County, WA. Some of the organizations within King County that own and maintain roads are listed. Under the Transportation Framework concept they would provide data to the Clearinghouse and to other parts of their own organization on roads they have built or changed by means of projects, work orders, or permits. In addition, they withdraw data from the Clearinghouse for roads within their area of interest that have been built or changed by actions of other road organizations. Similarly, there are organizations such as Puget Sound Regional Council (PSRC), and private road database vendors, such as GDT and Thomas Bros., who maintain road databases, but who do not maintain roads. Also, there are organizations who maintain neither roads nor road databases, but who need a roads database for GIS analyses. IRICC falls into this category. Emergency dispatch organizations (E911) are a special case. If road updates from the Clearinghouse are timely enough to meet their needs they could be a potential user of the clearinghouse. If not, E911 organizations might be a contributor of data for new roads, particularly if the reporting of road data from transportation organizations is not well recorded or reported.

Not all Transportation Framework (Roads) implementation issues can be fully anticipated. Remaining issues need to be explored in more detail. Pilot studies are proposed to address these concerns. Figure 3 is a copy of Figure 1 on which pilot studies are identified. The following pilot studies are proposed:

1. Pilot Study 1 is being conducted by ODOT. They are building a complete Roads database in Wasco County to demonstrate the feasibility of conflating data from BLM, Wasco County, ODOT, and DOQQ's. Pilot Study 1 will provide cost experience and technical issues relying on a single contractor to build a Transportation Framework by conflating data from several sources. This pilot is being extended to additional counties. In addition it should be extended to include insertion of annual updates from local governments, and the development of a check out process by which whole regions can be upgraded as better resolution data becomes available

Figure 2. Transportation Organizations Contribute and Withdraw Data from the Transportation Framework **(Roads)**



2. Pilot Study 2 is proposed for a county in Washington State. Pilot Study 2 would test the feasibility of compiling a complete Roads database by a process of handoffs from one organization to another, each adding roads from their GIS database. Pilot Study 2 would test the feasibility of a decentralized approach wherein several GIS organizations within a county adds their own data to the compilation of the Transportation Framework (Roads). This pilot will determine the extent to which GIS organizations are able and willing to participate in the effort. This pilot will also help determine whether proprietary data are significant barriers to sharing data.

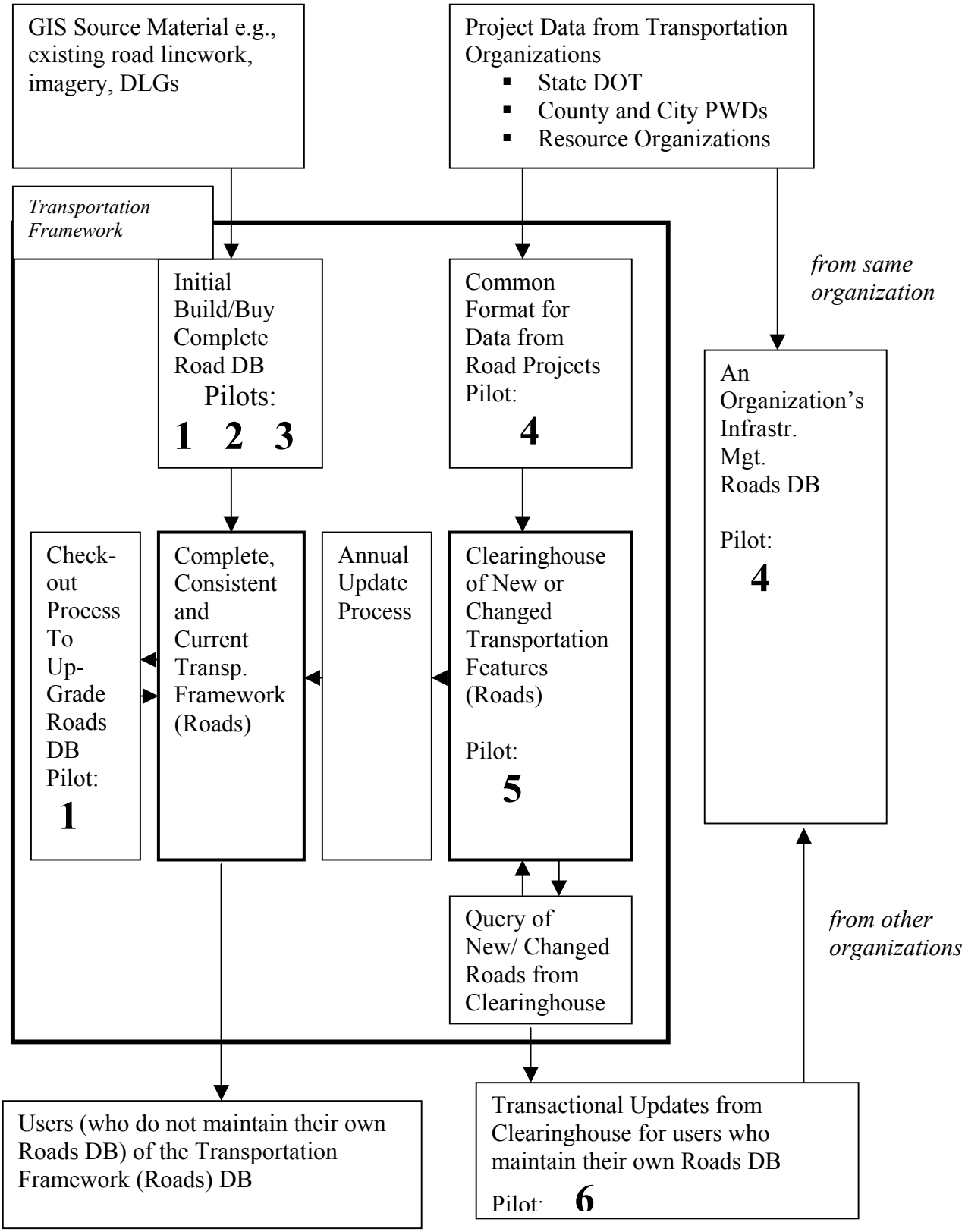
3. Pilot Study 3 is proposed for a group of counties in Washington State that do not have complete GIS data and would not be able to participate in a process as proposed in Pilot Study 2. Pilot Study 3 would contract with a vendor, GDT for example, to build and maintain the Transportation Framework (Roads). Pilot Study 3 will involve negotiations with vendors to determine costs of one-time purchase versus continued maintenance, a cost comparison of the most current data versus year old data, and dissemination constraints.

4. Pilot Study 4 is proposed for a jurisdiction in Washington State, e.g. Bellevue, who is interested in moving their Roads data to an enterprise-wide database. Pilot Study 4 would involve not only building a transaction updated Roads database, but would require extracting data in a consistent format from projects, permits, and work orders that build or modify roads and intersections. Pilot Study 4 would provide insight as to the feasibility of collecting data in a common format about new roads and changes to existing roads from the units of government that are responsible for them.

5. Pilot Study 5 is proposed to test the Clearinghouse concept. Pilot Study 5 would build a web-based collection of data about new and modified Roads. PSU has begun this Pilot Study with a prototype Internet application but it only contains mock data. Pilot Study 5 would test the Clearinghouse concept with real data.

6. Pilot Study 6 is a test of withdrawing data from the Clearinghouse and updating Roads databases. PSRC could take the lead in this by extracting data from Bellevue for updating their address geocoding database, their assignment network, and their ITS network. Pilot Study 6 would help determine the feasibility of transaction updating of application-specific road databases.

Figure 3. Building and Maintaining the Transportation Framework (Roads)



Scope of Pilot Studies

The six pilot studies outlined and discussed below are intended to test several key and interrelated concepts and procedures in building and maintaining the Transportation Framework (Roads). The location of each pilot study and its role in the Transportation Framework is shown in Figure 3.

The six pilot studies are meant to address issues that have been discussed and debated in previous versions of this White Paper but which need further study. As the diagram indicates, more than one study will be used to test a single concept or procedure (e.g., Pilots 1,2,3 test the compilation step), and one will test more than one procedure (e.g., Pilot Study 4 is used to test common format and transaction updating).

These pilot studies will provide empirical and qualitative evidence of what works and what does not in a variety of situations. Cost data and public domain issues that arise will be especially valuable, as these relate to two of the primary objectives of the Framework effort.

Five pilot studies are proposed for jurisdictions in Washington State, while the sixth is already underway in Wasco Co., Oregon. The results should be of use by both Washington and Oregon Transportation Framework initiatives, as well as by local jurisdictions, and by the IRICC Roads committee.

The first three pilot projects will serve to compare the integration of separate spatial data sets of transportation organizations to an already integrated road spatial data set. Table 4 presents a framework for thinking about the first three pilot studies. It displays different approaches for building a Transportation Framework (conflation versus enriching an already integrated database), whether it is developed in a centralized or decentralized environment, and includes both development and maintenance issues. Pilot Study 2 is a decentralized approach that enriches TIGER with GIS roads data from various organizations, while Pilot Studies 1 and 2 test the two centralized approaches.

Table 4
Framework for Pilot Studies

	Conflation Approaches		Enrichment Approaches	
Control	Centralized	Decentralized	Decentralized	Centralized
Example of starting point	Geometry-centric BLM GTRN	Data-centric IRICC Roads	TIGER	GDT
Construction process	Conflation of linework from various sources	Conflation of linework to develop roads DB	Enhance TIGER with attributes	Contract for enhancement with locally provided attributes
Transportation Framework Clearinghouse	State DOT as producer, steward and maintainer	Decentralized producers, State DOT steward and maintainer	Decentralized enhancement, State DOT steward and maintainer	Contracted products for state and local use
Maintenance	Annual recompilation	Transaction updating	Recompilation or transaction updating	Contracted transaction updating
Clearinghouse of changes		New or changed roads		Provide new or changed roads to contractor
Pilot Study	1	2	2	3

Scope for Pilot Studies 1 and 2

Pilot studies 1 and 2 will directly test the integration of federal, state and local road centerline files. Pilot Study 1 is already underway in Wasco County and partially completed by a University of Oregon research team for ODOT. The study is comparing and conflating road linework and attributes from BLM, Wasco County and ODOT, representing the centralized approach by a single contractor. This study does *not* include data from commercial vendors, and so sheds no light on the use of a commercially available database as the basis for the Transportation Framework. It will, however, provide previously unavailable cost and experience data that will allow an estimate of the cost of similar work.

In addition, the twofold concept can be tested by extending the study to several adjacent counties, and by including insertion of annual updates from local governments. The study should also include development of a check-out and check-in process by which whole regions can be upgraded as better resolution data becomes available.

The second pilot will also be a test of "stitching" or compiling together linework and data from several agencies. This is a decentralized approach that has long been

discussed and debated by the Washington and Oregon transportation framework groups. The test unit would in this case be a county in Washington state, replicating but extending the work already underway in the Wasco County Pilot discussed, but where the work would be performed by these organizations having GIS road databases. The steps of the production plan are specified below:

Steps in Building the Transportation Framework

Step 1: State adopts Modernized TIGER or GDT as the integrated seamless base file of the roadway universe.

Step 2: State DOT adds Anchor Points to state system at major intersections and county boundaries and assign IDs to these segments of roadways between Anchor Points. Relate these segments to the TIGER or GDT shape files. Sort by County and distribute to County Producers. Relate state system shape files (arcs) and attribute/inventory database records to these segments.

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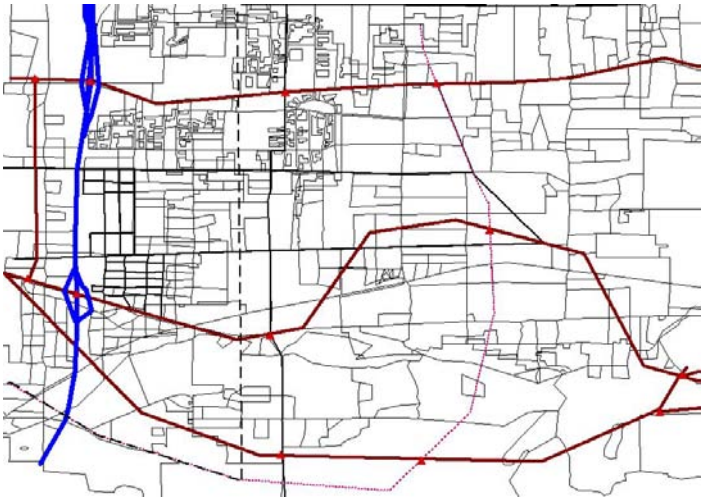
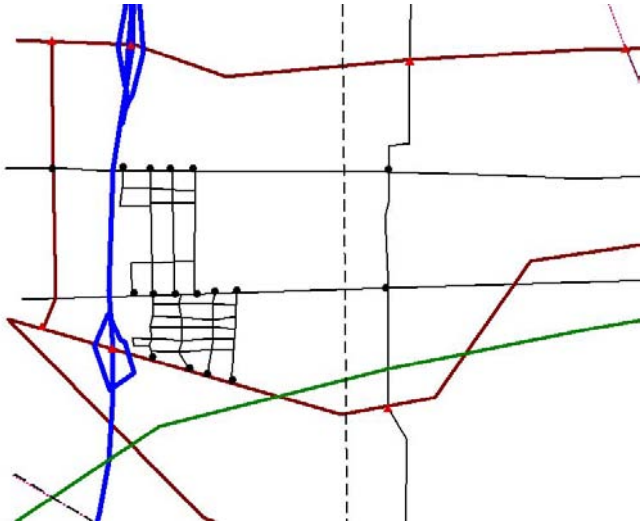


Step 3: Start with files from State DOT. County Producers add Anchor Points to City and County local roads to roadway beginning points, to intersections with

arterials, and to arterial roads at intersections with arterials of equal or higher rank, and assign IDs to these segments of roadway between Anchor Points. Relate County shape files (arcs) to these segments. Distribute to other road organizations in County, such as county and city public works departments, U.S. Forest Service, National Park Service, timber companies.



Step 4: Start with county files. Other transportation organizations may densify the Anchor Points, if needed. Each transportation organization shall relate their shape files and assign IDs to these segments of roadway between Anchor Points, and relate their attribute/inventory database records to these segments.

Step 5: State DOT incorporates all additions and maintains the Transportation Framework in a form that can be accessed in part or whole by users.

Contracting Out: Pilot Study 3

Pilot Study 3 will address another approach discussed in previous versions of this White Paper and among committee members, contracting out the development of the Transportation Framework (Roads) to a commercial vendor such as GDT. This pilot will address the needs of counties that do not have comprehensive GIS data and who therefore cannot or choose not to use the Pilot Study 2 approach.

The main concern of this pilot involves cost and public domain or dissemination issues. Costs will be determined along two dimensions or factors: one-time purchase of data with subsequent state and local maintenance, versus contracting out for data and maintenance. In both cases there are questions of public access to proprietary data. What limitations on dissemination or public access will the contractor impose? Or, at what price will those limitations be removed? We have been unable to answer these questions in a hypothetical context. They will have to be answered in the context of negotiating an actual contract for purchase. This pilot will negotiate these issues toward the development of a successful private-public partnership.

Another objective of Pilot Study 3 is to explore possible cost savings associated with the vendor's use of updates from the Clearinghouse. One purpose of the Clearinghouse is to facilitate updating road databases by any and all potential users. Consolidation of changes to the transportation system should reduce the cost of the database.

Transactional Updating: Pilot Study 4

Pilot Study 4 will address two issues related to the Transportation Framework: capturing and formatting new or modified road features, and a clearinghouse for depositing and accessing the data on new or modified roads. Pilot Study 4 consists of developing procedures for collecting, submitting, and retrieving data from all transportation organizations or jurisdictions concerning road-related projects, permits and work orders.

Pilot Study 4 will address two data sharing issues: sharing data inter-organizationally and intra-organizationally. Submitting data to the proposed Clearinghouse will enable one organization to know of changes made by another organization in common areas of overlapping concern or jurisdiction. Similarly, sharing of data among units within the same organization related to new or modified roads is needed. For instance, a change in signal timing may affect intersection capacity, which is of concern to the transportation planning group within the same unit of government. This type of intra-jurisdictional data sharing among stovepipe GIS systems will improve consistency and currency of data and reduce unnecessary data duplication. This pilot is proposed for a city, such as Bellevue, WA, or similar locale, that is in the process of adopting an enterprise-wide Roads database.

The purpose of Pilot Study 4 is to address the thorny and little discussed issue of maintenance of the Transportation Framework. Pilot Study 4 attempts to develop procedures for collecting and reporting data on new or modified roads that will serve the needs of the Transportation Framework and internal data sharing business needs of transportation organizations.

An important aspect of this Pilot Study is the institution of reporting requirements in the form of inducements or mandates to report changes to the roadway system. The major compliance tool would be to tie state-aid road funding to the reporting of changes.

The formatting of changes to road features is illustrated below. The first illustration is for a change in surface type and the second if a change in number of lanes by the addition of a turning lane. Only the attribute changed is reported, along with the date of change, the status (planned, under construction, open, closed, retired), the Transportation Feature ID, and the location along the feature measured by linear referencing. The data for a new road would have to include all attributes.

Change in surface type

Date:
Status from: open
Status to: open
Transportation Feature ID:
From MP:
To MP:
From Surf type: unimproved
To Surf type: asphalt

Change in number of lanes

Date:
Status from: open
Status to: construction
Transportation Feature ID:
From MP:
To MP:
From Number of Lanes Add Direc: 2
To Number of Lanes Add Direc: 3
Description: right turn lane
From coord. string:
To coord. string:

Clearinghouse of Transportation Feature Updates: Pilot Study 5

The purpose of Pilot Study 5 is to test, by means of prototyping with real data, the Clearinghouse concept. The Clearinghouse is a depository of new or modified road features coming directly from transportation organizations responsible for building or modifying roads, submitted to the Clearinghouse as transactions.

Pilot Study 5 will extend the Clearinghouse prototype that has been developed by (PSU). The PSU prototype is an ArcIMS application that demonstrates the input, query, and display from a database of new, retired, or changed Transportation Features using mock data. The Pilot Study 5 prototype Internet application needs to deal with real data from a representative county, or group of counties, to test submission procedures and the utility of data extracted from the Clearinghouse.

An important aspect of Pilot Study 5 is the visualization in the form of maps of Transportation Features selected as a result of a query. Thus persons selecting data would get visual feedback from their query of features, by type, date or location.

The final objective of Pilot Study 5 is to simulate the update process by inserting selected changes into a Roads database. This update will require matching on the Transportation Feature ID and using dynamic segmentation to locate along the feature, or using coordinates to find matching roads.

Using Data from the Clearinghouse for Updating Application-Specific Databases: Pilot Study 6

Regional GIS Clearinghouses can serve as repositories of more localized spatial databases. They can function in conjunction with State Clearinghouses for maintaining the Transportation Framework (Roads). As discussed in Dueker, Butler, Bender and Zhang (2001) they can be related to a statewide clearinghouse. Both state and regional clearinghouses would share relevant changes. In the Portland metropolitan region, Metro's Data Resource Center (DRC) already performs many functions of a regional transportation clearinghouse nature as part of its maintenance of the Regional Land Information System (RLIS) database.

In the Puget Sound area, this regional clearinghouse function could be taken on by the Seattle Metro or PSRC. In this pilot, either Seattle Metro or PSRC institute a day-forward, transaction-based approach to facilitate and disseminate updates, placing this approach in a regional context, and would require local jurisdictions to adopt a uniform update reporting format similar to that described above, placing in essence a top-down mandate for these individual jurisdictions to eventually adopt an Enterprise GIS.

Pilot Study 6 will test the "final step" of the updating of Roads databases maintained by others using data selected from the Clearinghouse. This is of concern to users who maintain their own Roads databases, but who do not maintain roads, such as the Puget Sound Regional Council (PSRC) and private Roads database vendors, such as GDT, Navtech and Thomas Brothers. In addition, transportation organizations who maintain roads and their own application-specific Roads databases will need to draw data from the Clearinghouse concerning roads in their jurisdiction that are owned and maintained by other transportation organizations.

It is proposed that PSRC undertake Pilot Study 6 and use data from the Clearinghouse to update the three different road databases they maintain: 1) address geocoding database, 2) traffic assignment network, and 3) ITS network. The important issue to be examined in this pilot is whether the transactions to record changes to roads can be made sufficiently robust to update databases of different types and detail. For this reason Pilot Studies 4 and 6 are inter-related and should be performed in a common study area, such as eastern King County, WA, including the City of Bellevue.

Options and Directions

This section provides some specific, but still tentative, cost options to help frame the discussion of how much robustness or functionality to build into the Washington State Transportation Framework (Roads). The White Paper has identified several Framework constituencies, each with slightly different priorities or business needs. How many of these business needs will be supported by the initial Transportation Framework (Roads)? The answer, in part, depends on: 1) willingness to provide funding, staff or database resources, needed to add functionality to meet specific

business needs, and 2) the extent to which those business needs are common to several stakeholders. For example, address geocoding is a business need common to several stakeholders, but unnecessary to others.

In addition, these choices of options enable the development of a *phased* approach to building the Framework, based on identifying and ranking business need priorities. The White Paper, along with further analysis of business needs, will assist in distilling these priorities and basic needs for the Framework.

Three options are identified and described below. These may be considered as functional "add-ons" to the basic, "best available" roads linework of a Framework that satisfies many GIS needs, including tight integration of the Transportation Framework (Roads) with other NSDI layers. There is great interest and need for integrating hydrography, cadastral, roads, railroads and bridge structures, including culverts, for salmon enhancement planning. In addition, this will include spatial accuracy improvements to the best available linework to support limited vehicle-tracking applications. Three optional enhancements to the basic linework follow directly from the analysis and identification of business needs:

- Address ranges and street names. Address geocoding functionality is of great interest and importance to emergency dispatch agencies and to many other users of address geocoding.
- Linear Referencing Systems (LRS) to support adding attributes of roads for and infrastructure (IMS) management.
- Network representations of the roadway system to support routing applications, such as disaster and contingency planning. Overweight/oversize truck routing would require additional data of height, weight and turn restrictions.

The three options listed above can be prioritized for phased implementation and to identify stakeholders willing to pay for the enhancement. A rough estimate of cost for compiling the basic linework statewide is estimated to be one million dollars per state (Washington and Oregon). This estimate does not include administration or management of the compilation process. Nor does it include the time and cost of determining exactly what data should be used, setting up data sharing partnerships, and other aspects of incorporating the concerns or stakeholders. Each additional option is estimated to cost $250,000 per state. The add-on cost of additional enhancements should be the responsibility of stakeholders who would benefit.

The White Paper concludes with this identification of options for stakeholders to consider in determining the desired robustness of the Transportation Framework and methods of allocating costs. Regardless of which combination of the three "add-ons" is selected instituting an update and maintenance process, such as the *transaction update* approach for new and modified transportation features is crucial to ongoing maintenance of the Framework. However, the cost estimates for the basic best available linework and the above listed add-on options do not include maintenance costs associated with building and operating the Clearinghouse of new and modified transportation features.

The priority of business needs drives not only the choice among options for functionality, it drives the way in which the Transportation Framework is built, structured, and maintained. The following scenarios illustrate the inter-relatedness of business needs, functional options, compilation method, data model, and maintenance method:

- If emergency dispatch is the highest priority, street addressing and relating wireless phone positions to the nearest street becomes the most important functionality of the Transportation Framework. This suggests starting with an existing integrated database, such as GDT or TIGER. Contracting database maintenance to a single contractor, GDT would provide for a more centralized process that enables use of a highly structured and detailed data model. On the other hand, a decentralized maintenance process would have to be supported by a more generalized data model that all participants could use.
- Giving salmon enhancement planning the highest priority requires a process of stitching together the best available linework with route identifiers and linear referencing to facilitate accessing bridge and culvert attributes from infrastructure management organizations (e.g. city, county, and state DOTs, FS, BLM).
- Ranking both needs equally may lead to consideration of ***two separate*** frameworks. These individual frameworks would serve to better handle contrasting and competing needs, balancing desired redundancy and unnecessary duplication. Use of common Anchor Points and Anchor Segments for these frameworks would allow for subsequent registration and integration with one another. The Transportation Framework Project Steering Committees for each individual framework could achieve stronger internal consensus and agreement, while maintaining external informal coordination with each other. This approach would be more costly, but would provide for better control by stakeholders with common needs.

These scenarios serve to illustrate that the possible ***choice set*** is large. The options are not mutually exclusive. Stakeholders will have to mix and match among options and combinations to decide how to best accommodate their business needs to take advantage of a cooperative effort to share costs of while at the same time minimizing the loss of control associated with a multi-participant effort. In other word, will the increases in spatial and temporal accuracy of the proposed Transportation Framework outweigh the risks of a multi-participant effort? As this discussion implies, uncertainty and risk inhibits buy in by Framework stakeholders. Consequently, reducing uncertainty and risk is a primary challenge. Meeting this challenge with the goal of achieving stakeholder confidence and support will require agreement on:

- A clear articulation of stakeholder business needs and the corresponding Transportation Framework functionality.
- Feasible and achievable cost, time, and overall resource estimates.

There are a number of institutional and technical barriers to achieving this consensus. Surmounting them can be difficult. These institutional and technical barriers to address are:

- Integration and conflation of transportation data from different sources and systems with different operational definitions of what a road is, different segmentation criteria, and different spatial and temporal accuracy.
- The need for Framework data to interface with specialized applications with proprietary formats (e.g., infrastructure management, address geocoding, and routing systems)
- Building consensus as to the content of a common framework layer in a multi-participant setting.
- Ever-changing and evolving conditions, expectations, and needs of Framework stakeholders.
- Resource and funding requirements and uncertainties in relation to control and time issues of managing a multi-participant effort.

Although the White Paper addresses these issues and advances the consensus–seeking process, it is now time for stakeholders to participate in the decision and development process towards a multi-purpose Transportation Framework. The problems of continuing along separate paths are growing.

Conclusions

This White Paper provides synthesis of issues and alternatives in the development of a Transportation Framework for Washington. The recommended two-part approach to the Transportation Framework will accommodate pressing applications, such as the need for a roads spatial data set for salmon enhancement planning. At the same time, the Clearinghouse concept to start collecting more detailed data on new or modified roads will enable gradual upgrading to a more robust Transportation Framework. In addition, the more detailed data on new roads will provide others with resources to update their own Roads database.

The White Paper serves the Transportation Framework initiatives in both Washington and Oregon in support of a broad range of applications in resource management, emergency management, infrastructure management, and services management. The White Paper defines the purposes of pilot projects needed to test some of the assumptions and issues that are still outstanding. The completion of these pilot studies will help to determine if the proposed two-part approach to the Transportation Framework is workable and feasible.

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Appendix A

IRICC Transportation Framework
Route Core Data

DRAFT 9/19/2000

D. Guenther, REO. Core_Data

The following lists the agreed upon set of core data necessary for the Transportation Framework project. All data is linked to spatial information, which defines a route. A route is a user defined section of road. This document will focus on describing the core data attributes only. For Framework spatial requirements please refer to the Transportation Spatial Requirements document. For Framework data standards for transportation structures, refer to the Framework Structures Core Data document.

These elements were developed consensus from the partners. Core data is data common to all participating agency datasets. Core data may not include all common data, but relative to broad scale needs.

Data Elements:

1. File Header Information: **Required values are in bold type.**
This information pertains to all information being submitted. It describes a file transfer event, describing all data submitted.

Origination Date - Date the file or information is submitted.
Field Name: ORIGINATION_DATE Type: Date.
Validation Date - Date the data is current.
Field Name: VALIDATION_DATE Type: Date.
Projection - The name of the projection which the line work was developed in.
Field Name: PROJECTION**.** Type: Alpha. Size: 50.
Coordinate System - The coordinate system the line work was developed in.
Field Name: COORDINATE_SYSTEM Type: Alpha. Size: 50.
Datum - The geographic Datum the line work was developed in.
Field Name: DATUM. Type: Alpha. Size: 50.

2. Feature Attributes:
This information pertains to a specific data element or record being submitted. Each record will have a different set of data.

Road Location Information
Framework Unique Identifier - A system generated unique permanent identifier. As records are submitted to the Framework Clearinghouse each record will be assigned a unique ID. This ID may then be used and tracked by participants in sharing data across ownerships.
Field Name: FRAMEWORK_ID. Type: Integer. Size: 7.

Agency Unique Identifier - The unique ID which the contributing agency has assigned to the feature.
Field Name: LOCAL_ID. Type: Alpha. Size: 50.

State - Code for State where the road is located. FIPS codes will be used.
Field Name: STATE. Type: Alpha. Size: 2.

County - County FIPS code for feature location. FIPS codes will be used.
Field Name: COUNTY. Type: Alpha. Size: 3.

Metadata Information

Feature Source Type - The compilation map or image source used when adding or updating transportation data.

These codes can be found in the associated lookup table listed in Section 4 - Appendix.
Field Name: FEATURE_SOURCE_TYPE. Type: Alpha. Size: 25.

Feature Source Date - The compilation map or image source date used for the addition or update of transportation data.

Example: 19990515 (CCYYMMDD = May 15, 1999)
Field Name: FEATURE_SOURCE_DATE. Type: Date. Size: Date.

Feature Source Scale Number - Describes the scale denominator of the map or image source for the transportation data additions or updates in the database. Exact scale can be input. The density of transportation features displayed will vary by the base map scale.

Example: 24000
Field Name: FEATURE_SOURCE_SCALE_NUMBER. Type: Alpha. Size: 6.

Feature Accuracy Type - Describes the positional accuracy of the transportation data being added or updated in the database. Describes the correctness of the measurement. Use actual value e.g. .001; 3; 100. All units are entered in meters.
Field Name: FEATURE_ACCURACY_TYPE. Type: Alpha. Size: 4.

Road Specific Attributes

Road Name - Road name(s) which have been assigned. Note: either NAME or Road_Number is required. If unknown then OWNER must be filled in as unknown.
Field Name: NAME. Type: Alpha. Size: 35.

Alternate Road Name - List of all other known names.
Field Name: ALTERNATE _NAME Type: Alpha. Size: 35.

Direction Prefix - Directional indication code (i.e. NE).
Field Name: PREFIX. Type: Alpha. Size: 2.

Direction Suffix - Directional indication code (i.e. NE).

Field Name: SUFFIX. Type: Alpha. Size: 2.

Road Number - Road numbers(s) which have been assigned. Note: either NAME or Road_NUMBER is required. If unknown then OWNER must be filled in as unknown.
Field Name: ROAD_NUMBER. Type: Alpha. Size: 15.

Alternate Road Number - List of all other known road numbers.
Field Name: ALTERNATE_ROAD_NUMBER. Type: Alpha. Size: 15.

Measure Method - Date and comment type description of how the FROM and TO measures were generated (ex. Odometer).
Field Name: MEASURE_METHOD. Type: Alpha. Size: 50.

From Milepost - The 'FROM' milepost where the road segment value starts.
Field Name: FROM_MP. Type: Real. Size: 999.99

To Milepost - The 'TO' milepost where the road segment value ends.
Field Name: TO_MP. Type: Real. Size: 999.99

From_ARM - The 'FROM' milepost where the field measured Accumulated Route Mile (ARM) value starts.
Field Name: FROM_ARM. Type: Real. Size: 999.99

To ARM - The 'TO' milepost where the field measured Accumulated Route Mile (ARM) value ends. Field Name: TO_ARM Field Name: Type: Real. Size: 999.99

Inventory Direction - The direction of the inventory (increasing or decreasing) for dual lane roads.
Field Name: DIRECTION. Type: Alpha. Size: 10.

Right Side Address Low - Lowest street address on the right side in direction of increasing addresses.
Field Name: RT_FROM_ADD. Type: Alpha. Size: 6.

Left Side Address Low - Lowest street address on the left side in direction of increasing addresses.
Field Name: LF_FROM_ADD. Type: Alpha. Size: 6.

Right Address High - Highest street address on the right side in direction of increasing addresses.
Field Name: RT_TO_ADD. Type: Alpha. Size: 6.

Left Address High - Highest street address on the left side in direction of increasing addresses.
Field Name: LF_TO_ADD. Type: Alpha. Size: 6.

Left Zip - Postal zip code on left side of feature in direction of increasing addresses.
Field Name: LZIP_TYPE. Type: Alpha. Size: 10.

Right Zip - Postal zip code on Right side of feature in direction of increasing addresses.
Field Name: RZIP_TYPE. Type: Alpha. Size: 10.

Owner Level - Jurisdictional level of owner of facility (see code list) (i.e. Federal).
Field Name: OWNED**.** Type: Alpha. Size: 1

Owner Name - Jurisdictional classification or name of facility owner (see code list) (i.e. Forest Service).
Field Name: OWNER**.** Type: Alpha. Size: 35.

Manager Level - Jurisdictional level of manager of facility (see code list) (i.e. Federal).
Field Name: MANAGED**.** Type: Alpha. Size: 1

Manager Name - Jurisdictional classification or name of facility manager (see code list) (i.e. Forest Service). Field Name: **MANAGER.** Type: Alpha. Size: 35.

Functional Classification - Functional classification (i.e. Interstate). This includes railroad and utility pipelines.
Field Name: **FUNCCLS.** Type: Alpha. Size: 35.

Functional Type - Functional type (i.e. U=Urban).
Field Name: FUNCTYP**.** Type: Alpha. Size: 1.

SOURCE - Jurisdictional level at which data originates (see code list) (i.e. Federal).
Field Name: SOURCE. Type: Alpha. Size: 1

Source Agency - Jurisdictional classification or name of agency that submits the data (see code list) (i.e. Forest Service).
Field Name: SOURCE_AG**.** Type: Alpha. Size: 35.

Road Status - Code for the management of the road. (Ex. R=Retired, O=Operating, P=Proposed).
Field Name: STATUS. Type: Alpha. Size: 1

Surface Type - The code showing surface type of the feature. (Ex. H=Hard Surface, G=Gravel, D=Dirt).
Field Name: SURFACE_TYPE. Type: Alpha. Size: 1.

IRICC Transportation Framework
Structures Core Data
8/16/2000

D. Guenther, REO. Structure_Core_Data

The following lists the agreed upon set of core data necessary for the Transportation Framework project. All data is linked to spatial information, which defines a route. A route is a user defined section of road. This document will focus on describing the core data attributes only. For Framework spatial requirements please refer to the Transportation Spatial Requirements document. For Framework data standards for transportation structures, refer to the Framework Structures Core Data document.

These elements were developed consensus from the partners. Core data is data common to all participating agency datasets. Core data may not include all common data, but relative to broad scale needs.

Fields in **bold** are required for the Framework Clearinghouse.

Data Elements:

1. File Header Information:
This information pertains to all information being submitted. This describes a file transfer event, describing all data submitted.

Note: Location coordinates will refer to the center point of the structure. Fields in bold are required for the Framework Clearinghouse.

Framework Structure ID – To uniquely identify each structure. Source: Generated by Clearinghouse.
Field Name: STRUCTURE_ID. Type: Integer. Size: 15

Agency Structure ID – Unique ID from data source agency. Used to link framework data to agency data.
Field Name: LOCAL_STRUCTURE_ID. Type: Character. Size: 35

Latitude - The Latitude for the structure.
Field Name: X. Type: Integer. Size: 7.

Longitude - The Longitude for the structure.
Field Name: Y. Type: Integer. Size: 7.

Elevation - The elevation above mean sea level for the structure.
Field Name: Elevation. Type: Integer. Size: 4.

Source Information- General information as to the source of the data.
Field Name: SOURCE_INFORMATION. Type: Alpha. Size: 240 characters.

Route Framework ID- To designate which route a structure is on. Route_Framework_ID is a system generated unique permanent identifier. As records are submitted to the Framework Clearinghouse a lookup based on supplied Local_Route_ID and Source will provide the unique ID. This ID may then be used by participants in sharing data across ownerships.
Field Name: ROUTE_FRAMEWORK_ID. Type: Integer. Size: 7 characters.

Local Route ID - The unique ID which the contributing agency has assigned to the route.
Field Name: LOCAL_ROUTE_ID. Type: Alpha. Size: 50 characters.

Accumulated Route Measurement - The milepost where the structure is located on the route. Route mile accumulated from the beginning of a route in the direction of a roadway.
Field Name: ARM. Type: Real. Size: 999.99 (Where does this start?).

Structure Class - Designation for the general type of structure (Valid: culvert, bridge, ford or road blockage).
Field Name: STRUCTURE_CLASS. Type: Alpha. Size: 25.

Owner Level - Jurisdictional level of owner of facility (see code list) (i.e. Federal).
Field Name: OWNED. Type: Alpha. Size: 1

Owner Name - Jurisdictional classification or name of facility owner (see code list) (i.e. Forest Service).
Field Name: OWNER. Type: Alpha. Size: 35 characters.

Owner Level - Jurisdictional level of manager of facility (see code list) (i.e. Federal).
Field Name: MANAGED. Type: Alpha. Size: 1

Manager Name - Jurisdictional classification or name of facility manager (see code list) (i.e. Forest Service).
Field Name: **MANAGER**. Type: Alpha. Size: 35 characters.

Feature Source Type - The compilation map or image source used when adding or updating transportation data.

These codes can be found in the associated lookup table listed in Section 4 - Appendix.
Field Name: FEATURE_SOURCE_TYPE. Type: Alpha. Size: 25.

Feature Source Date - The compilation map or image source date used for the addition or update of transportation data.

Example: 19990515 (CCYYMMDD = May 15, 1999)
Field Name: FEATURE_SOURCE_DATE. Type: Date. Size: Date.

Feature Source Scale Number - Describes the scale denominator of the map or image source for the transportation data additions or updates in the database. Exact scale can be input. The density of transportation features displayed will vary by the base map scale.

Example: 24000
Field Name: FEATURE_SOURCE_SCALE_NUMBER. Type: Alpha. Size: 6.

Feature Accuracy Type - Describes the positional accuracy of the transportation data being added or updated in the database. Describes the correctness of the measurement. Use actual value, e.g., .001; 3; 100. All units are entered in meters.
Field Name: FEATURE_ACCURACY_TYPE. Type: Alpha. Size: 4.

Note: States and federal agencies do not seem to be tracking anchor points, but looking at reasons for relevance and importance. Are they necessary for sharing transportation data, or linking transportation framework to hydrography.

Culverts: In addition to the above attributes, culvert core data will include the following. (Note: when fish and hydro data needs are known they will be included):

Culvert Type- The shape and material for the culvert. (E.g. Ellipse, concrete).
Field Name: TYPE. Type: Alpha. Size: 25.

Culvert Size - The diameter or area of the culvert.
Field Name: SIZE. Type: integer. Size: 2.

Culvert Length - The length of the structure.
Field Name: LENGTH. Type: integer. Size: 3.

Bridges: In addition to the above attributes, bridge core data will also include the following:

NBI - The code assigned to all bridges and dams under the National Bridge Inventory.
Field Name: **NBI**. Type: Integer. Size: 5

Fish passage and hydrography attributes: In addition to the location information above, these structures will include fisheries and hydrography information as determined by the agency specialists. This section is a place holder for this information to be attached to the transportation framework information set. This information will then be linked to the hydrography framework as well.

Example:
Fish_Passage – A Y/N field describing whether fish can pass this barrier.
Fish_Species – The species related to fish passage. Code value based on scientific name.

Possible Solutions for Improving Geocoding Capabilities in the WA-Trans Database

11/23/2004

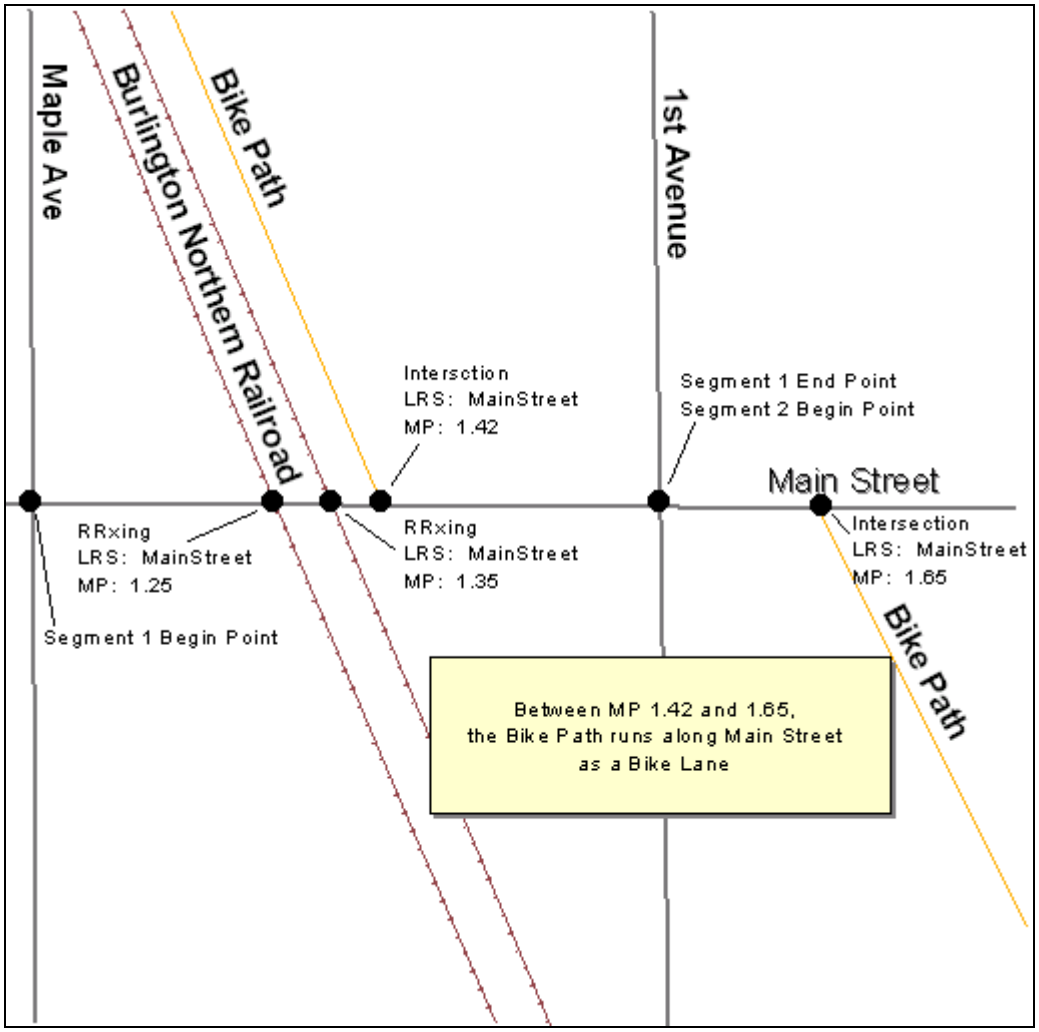
Michelle Blake
WSDOT GIS Data Administrator

Background: The current WA-TRANS data model includes the business rule that features be broken at all at-grade intersections. The resulting roadway segmentation – especially for railroad crossings and bike path crossings with roadways – can reduce geocoding capabilities. The reduced capability is partly due to address pro-ration issues along blocks with multiple, non-road crossings and due to the increase in the number of records that Computer Aided Dispatch systems must search for emergency response. Since geocoding capabilities are an important identified business need for WA-Trans, the model and business rules must support such functionality in a manner usable by the Partners, while not diminishing other identified needs.

This document suggests some possible solutions for the WA-Trans Steering Committee and Data Model Committee to consider.

1. Use Point Event tables to locate at-grade, non-road crossings with roadways.

Situations where this type of approach may apply: an at-grade intersection of a bike path with a roadway or an at-grade railroad crossing with a roadway. Features like these may occur anywhere along a road segment – not necessarily at the endpoints of a segment. Such features can be handled as events along the roadway.



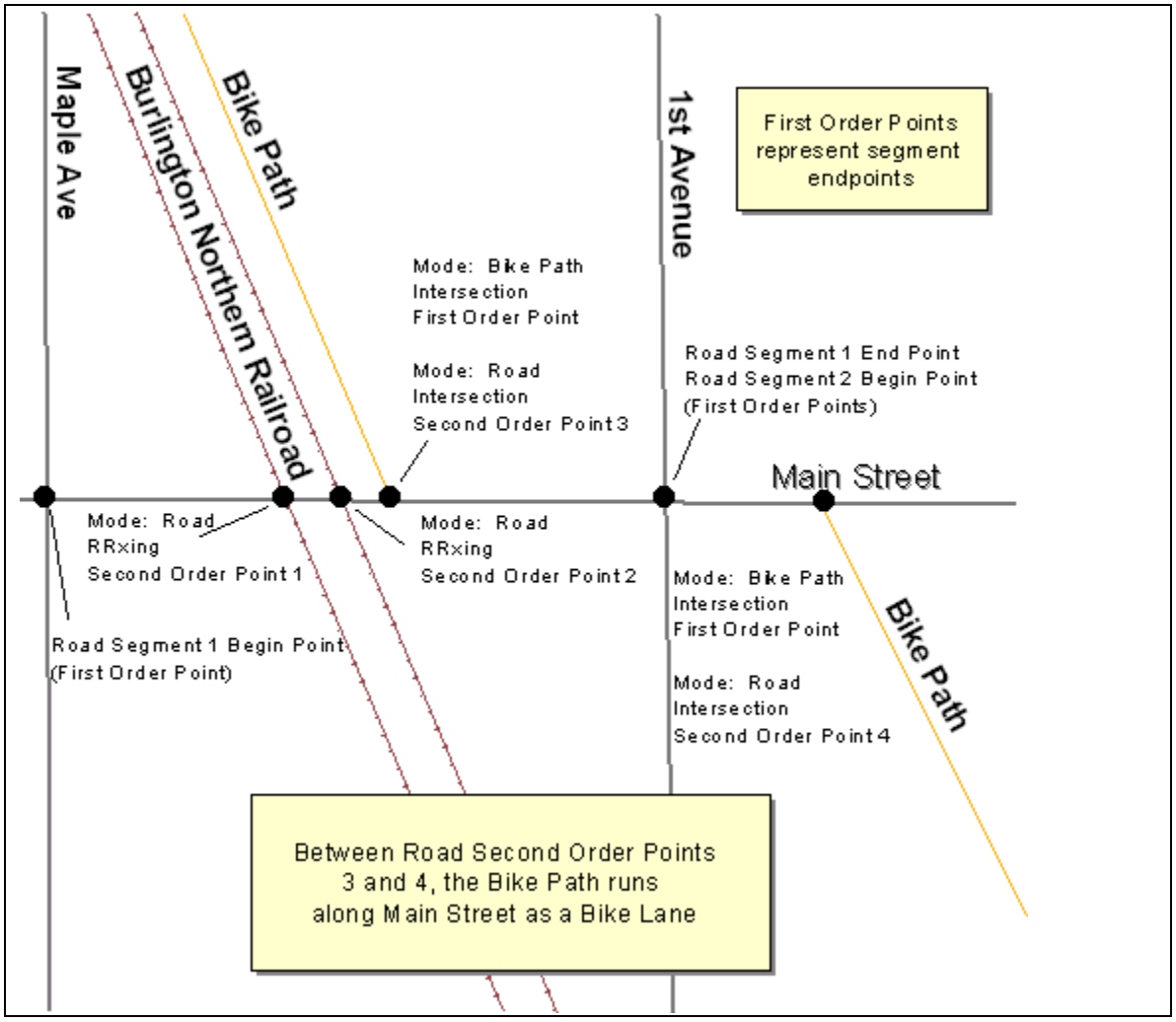
Pros – Avoids over-segmentation of roadway features, but maintains the intersection information for possible use in geometric networks. This approach is being similarly utilized for bridges and tunnels (linear features) along roadways to avoid over-segmentation.

This method has also been suggested as a solution for handling "submode" situations where modes share the roadway for a length (as in the Bike Path in the above illustration), and are in essence a feature of the roadway.

Cons – Some entities may wish to treat these mutli-modal intersections as agreement points with formal XY definitions of the location.

2. Use Second Order Points to identify at-grade, non-road crossings with roadways.

Oregon DOT utilizes Second Order Points as a means of identifying special types of intersections that will not be used to break the roadway segment. ODOT uses such a mechanism to describe intersections of public roads with private roads and intersections of public roads with the driveway/entrances of major retailers.

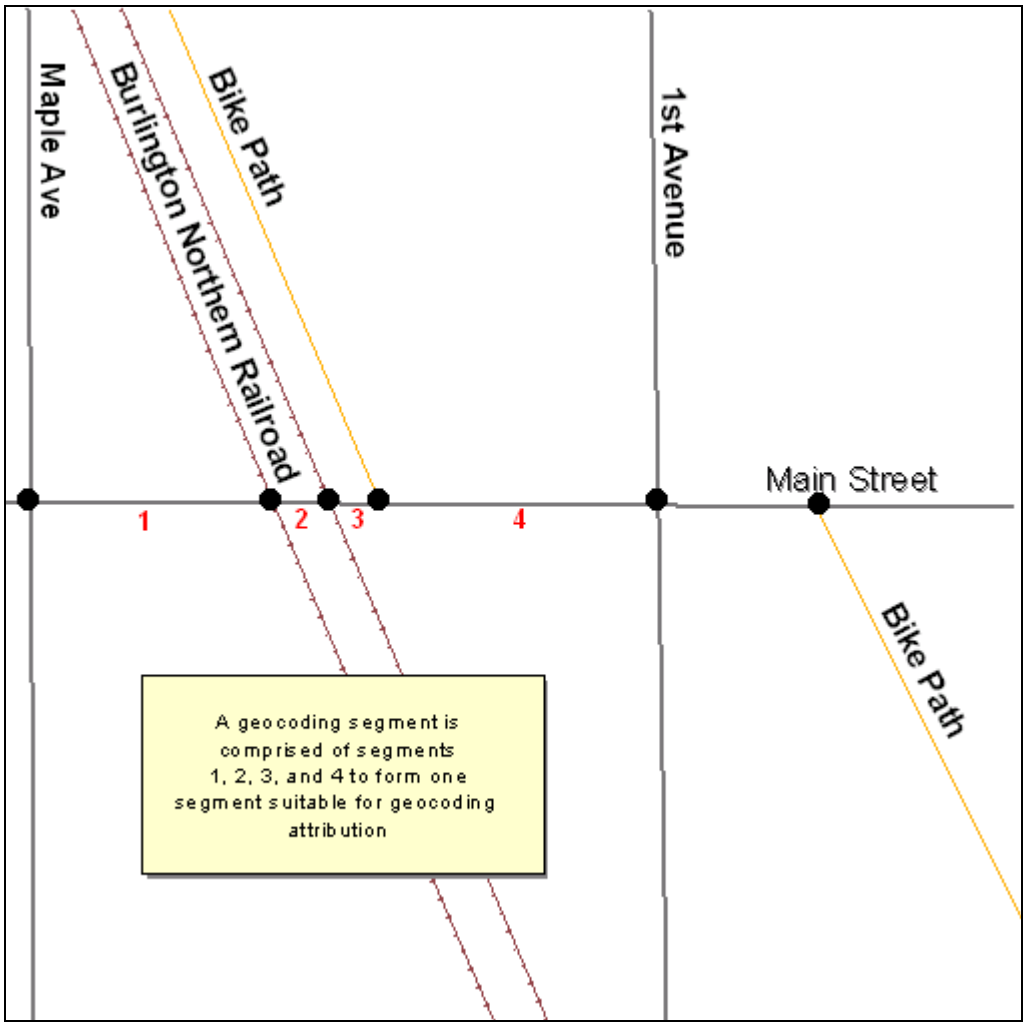


Pros – Avoids over-segmentation of roadway segments, while allowing the possibility for entities to define agreement points at the intersection. Such a point can stand alone and provide a means to clip a roadway segment if needed for a geometric network. If such a clip were employed, it should only be run against the LRS milepoint portion of the roadway description – not the geocoding part.

Cons – The use of Second Order Points may complicate "to/from" attribution. Can a point be both a first order point for one mode and a second order point for another? If so, another table will have to be added to the database to join the mode with the point order to accommodate such situations. Care will need to be taken in the Segment Description table to use only first order points as the to and from points for the appropriate mode.

3. Utilize a Path Table to aggregate roadway segments. The aggregated roadway segments then would be described for geocoding use.

This method would apply the current "Segment Description Road" to an applicable path (an aggregated group of road segments). In this manner, geocoding attribution could be applied to the appropriate span of a roadway.

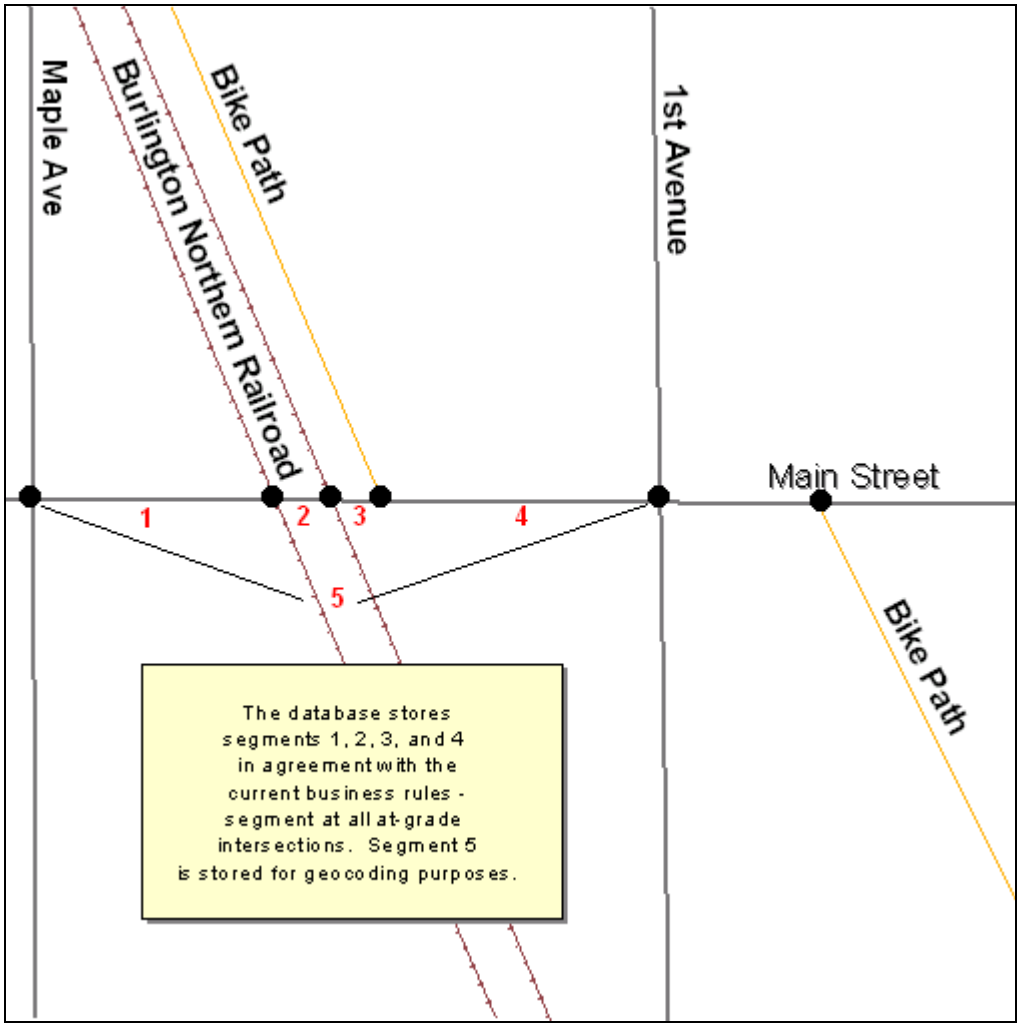


Pros – Provides a means to build geocodable segments without having to duplicate geometry, while maintaining network functionality. Such a build might need to be performed in some manner to create routes for event placement for use with the translator.

Cons – May be difficult to load the path information. Care will need to be taken that the path be aggregated as one feature upon translation for export - not multiple parts referenced by a path.

4. Include geocoding segments separate from the segments used for connectivity.

A separate segment for geocoding could be included in the segment table. This segment could be maintained in a topological relationship with the non-geocoding roadway segments.

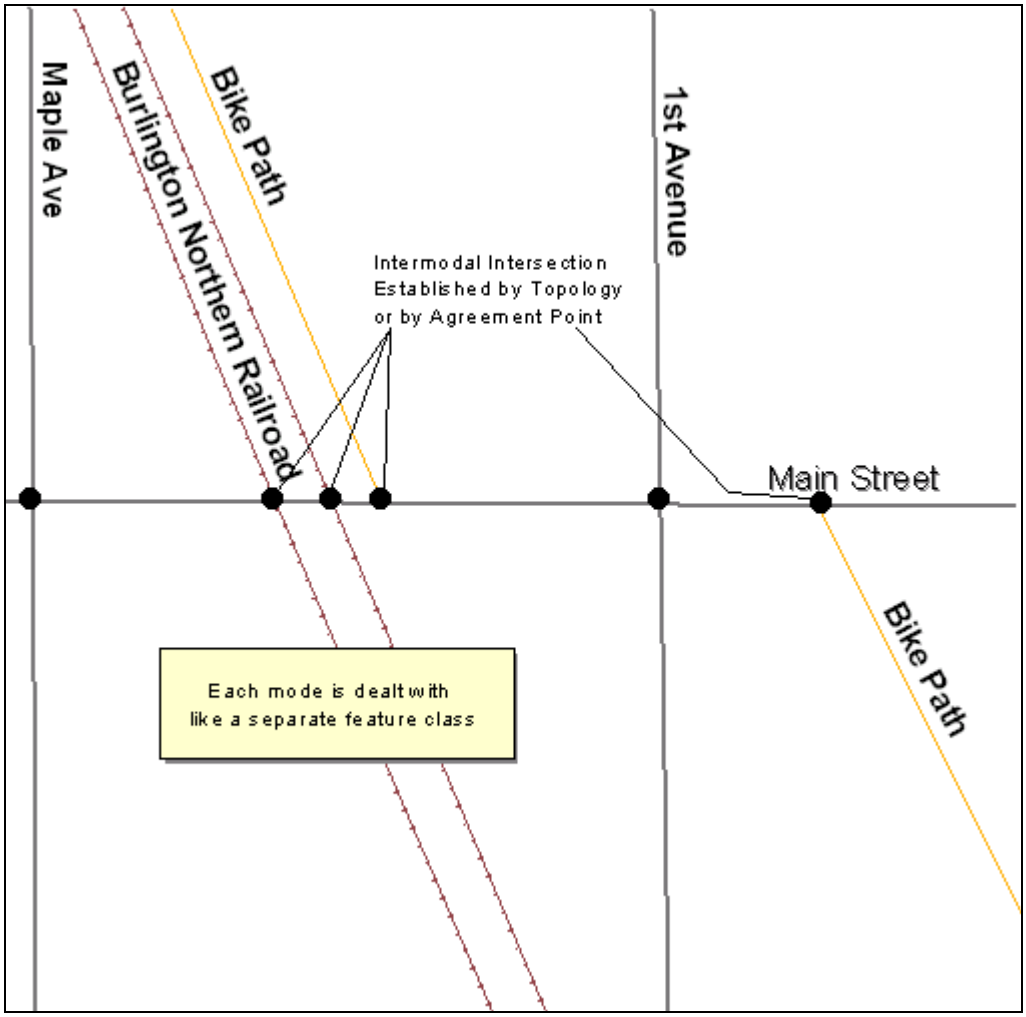


Pros – This would allow for accommodating the complexity of geocoding segments within the existing model.

Cons – Roadway geometry data would be duplicated, which would greatly increase the size of the database. Care would need to be taken to avoid non-geocoding segments and geocoding segments from getting out of sync.

5. Separate all modes out into their own database - or into their own sets of related tables within the same database.

This method allows each mode to have its own geography table – utilizing more of a traditional GIS setup for the database. Agreement points could be maintained and established through topological relationships, and business rules could be set to treat "submode" activities as a feature (event) of a particular mode. The separate geometries can be brought together via the translator's GIS capabilities to create geometric network data.



Pros – Utilizes more of a GIS-ready format. Many providers already maintain and store data in such a structure. Simplifies data storage for each mode.

Cons – Tables, fields, and identifiers will be repeated throughout the database, and the structure will not as efficiently handle situations where modes share geometries. Data retrieval via translation may take additional processing, depending on the type of data requested for extraction. This method of storage can be mimicked in the current data model by modifying the business rules for segmentation and by creating Views of individual modes.

IRICC Transportation Framework
Route Core Data
DRAFT

8/16/2000

D. Guenther, REO. Core_Data

The following lists the agreed upon set of core data necessary for the Transportation Framework project.

These elements were developed consensus from the partners. Core data is data common to all participating agency datasets. Core data may not include all common data, but relative to broad scale needs.

Data Elements:

1. File Header Information: **Required values are in bold type.**
This information pertains to all information being submitted.

ORIGINATION_DATE - Date the file or information is submitted. Type: Date.
VALIDATION_DATE - Date the data is current. Type: Date.
PROJECTION - The name of the projection which the line work was developed in. Type: Alpha. Size: 50.
COORDINATE_SYSTEM - The coordinate system the line work was developed in. Type: Alpha. Size: 50.
DATUM - The geographic Datum the line work was developed in. Type: Alpha. Size: 50.

2. Feature Attributes:
This information pertains to a specific data element or record being submitted. Each record will have a different set of data.

Road Location Information
FRAMEWORK_ID - A system generated unique permanent identifier. As records are submitted to the Framework Clearinghouse each record will be assigned a unique ID. This ID may then be used and tracked by participants in sharing data across ownerships. Type: Integer. Size: 7 characters

LOCAL_ID - The unique ID which the contributing agency has assigned to the feature. Type Alpha. Size: 50 characters.

STATE - Code for State where the road is located. FIPS codes will be used. Type: Alpha. Size: 2 characters.

COUNTY - County FIPS code for feature location. FIPS codes will be used. Type: Alpha. Size: 3 characters.

Metadata Information

Feature source code - The compilation map or image source used when adding or updating transportation data.

These codes can be found in the associated lookup table listed in Section 4 - Appendix.

Feature source date - The compilation map or image source date used for the addition or update of transportation data.

Example: 19990515 (CCYYMMDD = May 15, 1999)

Feature source scale number - Describes the scale denominator of the map or image source for the transportation data additions or updates in the database. Exact scale can be input. The density of transportation features displayed will vary by the base map scale.

Example: 24000

Feature accuracy code - Describes the positional accuracy of the transportation data being added or updated in the database. Describes the correctness of the measurement. Use actual value eg. .001; 3; 100. All units are entered in meters.

Road Specific Attributes

NAME - Road name(s) which have been assigned. Note: either NAME or Road_NUMBER is required. If unkown then OWNER must be filled in as unknown. Type: Alpha. Size: 99 characters.

ALTERNATE _NAME - List of all other known names. Type: Alpha. Size: 99 characters.

PREFIX - Directional indication code (i.e NE). Type: Alpha. Size: 2 characters.

SUFFIX - Directional indication code (i.e NE). Type: Alpha. Size: 2 characters.

ROAD_NUMBER - Road numbers(s) which have been assigned. Note: either NAME or Road_NUMBER is required. If unkown then OWNER must be filled in as unknown. Type: Alpha. Size: 99 characters.

ALTERNATE_ROAD - List of all other known road numbers. Type: Alpha. Size: 99 characters.

MEASURE_METHOD - Date and comment type description of how the FROM and TO measures were generated (ex. Odometer). Type: Alpha. Size: 50.

FROM_MP - The FROM milepost where the road segment value starts. Type: Real. Size: 999.99

TO_MP - The TO milepost where the road segment value ends. Type: Real. Size: 999.99

FROM_ARM - The FROM milepost where the field measured Accumulated Route Mile (ARM) value starts. Type: Real. Size: 999.99

TO_ARM - The TO milepost where the field measured Accumulated Route Mile (ARM) value ends. Type: Real. Size: 999.99

DIRECTION - The direction of the inventory (increasing or decreasing) for dual lane roads. Type: Alpha. Size: 10.

RT_FROM_ADD - Lowest street address on the right side in direction of increasing addresses. Type: Alpha. Size: 6.

LF_FROM_ADD - Lowest street address on the left side in direction of increasing addresses. Type: Alpha. Size: 6.

RT_TO_ADD - Highest street address on the right side in direction of increasing addresses. Type: Alpha. Size: 6.

LF_TO_ADD - Highest street address on the left side in direction of increasing addresses. Type: Alpha. Size: 6.

LZIP_CODE - Postal zip code on left side of feature in direction of increasing addresses. Type: Alpha. Size: 10 characters.

RZIP_CODE - Postal zip code on Right side of feature in direction of increasing addresses. Type: Alpha. Size: 10 characters.

OWNED - Jurisdictional level of owner of facility (see code list) (i.e. Federal). Type: Alpha. Size: 1

OWNER - Jurisdictional classification or name of facility owner (see code list) (i.e. Forest Service). Type: Alpha. Size: 35 characters.

MANAGED - Jurisdictional level of manager of facility (see code list) (i.e. Federal). Type: Alpha. Size: 1

MANAGER - Jurisdictional classification or name of facility manager (see code list) (i.e. Forest Service). Type: Alpha. Size: 35 characters.

FUNCCLS - Functional classification (i.e. Interstate). This includes railroad and utility pipelines. Type: Alpha. Size: 35 characters.

FUNCTYP - Functional type (i.e. U=Urban). Type: Alpha. Size: 1 character.

SOURCE - Jurisdictional level at which data originates (see code list) (i.e. Federal). Type: Alpha. Size: 1

SOURCE_AG - Jurisdictional classification or name of agency that submits the data (see code list) (i.e. Forest Service). Type: Alpha. Size: 35 characters.

STATUS - Code for the management of the road. (Ex. R=Retired, O=Operating, P=Proposed). Type: Alpha. Size: 1

SURFACE_TYPE - The code showing surface type of the feature. (Ex. H=Hard Surface, G=Gravel, D=Dirt). Type: Alpha. Size: 1.

IRICC Transportation Framework
Structures Core Data

8/16/2000

D. Guenther, REO. Structure_Core_Data

The following lists the agreed upon set of core data necessary for the Transportation Framework project.

These elements were developed consensus from the partners. Core data is data common to all participating agency datasets. Core data may not include all common data, but relative to broad scale needs.

Data Elements:

1. File Header Information: **Required values are in bold type.**
This information pertains to all information being submitted.

Note: Location coordinates will refer to the center point of the structure. Fields in bold are required for the Framework Clearinghouse.

- STRUCTURE_ID – To uniquely identify each structure. Source: Generated by Clearinghouse. Type: Integer. Size: 15
- **LOCAL_STRUCTURE_ID** – Unique ID from data source agency. Used to link framework data to agency data. Type: Character. Size: 35
- **X** - The Latitude for the structure. Type: Integer. Size: 7.
- **Y** - The Longitude for the structure. Type: Integer. Size: 7.
- Z - The elevation above mean sea level for the structure. Type: Integer. Size: 4.
- **SOURCE_INFORMATION** - General information as to the source of the data. Type: Alpha. Size: 240 characters.
- ROUTE_FRAMEWORK_ID - To designate which route a structure is on. Route_Framework_ID is a system generated unique permanent identifier. As records are submitted to the Framework Clearinghouse a lookup based on supplied Local_Route_ID and Source will provide the unique ID. This ID may then be used by participants in sharing data across ownerships. Type: Integer. Size: 7 characters.
- **LOCAL_ROUTE_ID** - The unique ID which the contributing agency has assigned to the route. Type Alpha. Size: 50 characters.
- **ARM** – Accumulated Route Measurement. The milepost where the structure is located on the route. Route mile accumulated from the beginning of a route in the direction of a roadwayType: Real. Size: 999.99 (Where does this start?).
- **STRUCTURE_CLASS** - Designation for the general type of structure (Valid: culvert, bridge, ford or road blockage). Type: Alpha. Size: 25.
- **OWNED** - Jurisdictional level of owner of facility (see code list) (i.e. Federal). Type: Alpha. Size: 1

- **OWNER** - Jurisdictional classification or name of facility owner (see code list) (i.e. Forest Service). Type: Alpha. Size: 35 characters.
- **MANAGED** - Jurisdictional level of manager of facility (see code list) (i.e. Federal). Type: Alpha. Size: 1
- **MANAGER** - Jurisdictional classification or name of facility manager (see code list) (i.e. Forest Service). Type: Alpha. Size: 35 characters.

- **Feature source code** - The compilation map or image source used when adding or updating transportation data.

These codes can be found in the associated lookup table listed in Section 4 - Appendix.

- **Feature source date** - The compilation map or image source date used for the addition or update of transportationse data.

  Example: 19990515 (CCYYMMDD = May 15, 1999)

- **Feature source scale number** - Describes the scale denominator of the map or image source for the hydrography watercourse data additions or updates in the database. Exact scale can be input. The density of hydrography features displayed will vary by the base map scale.

  Example: 24000

- **Feature accuracy code** - Describes the positional accuracy of the hydrography watercourse data being added or updated in the database. Describes the correctness of the measurement. Use actual value eg. .001; 3; 100. All units are entered in meters.

Note: States and federal agencies do not seem to be tracking anchor points, but looking at reasons for relevance and importance. Are they necessary for sharing transportation data, or linking transportation framework to hydrography.

Culverts: In addition to the above attributes, culvert core data will include the following. (Note: when fish and hydro data needs are known they will be included):

- **Type** - The shape and material for the culvert. (Eg. Ellipse, concrete). Type: Alpha. Size: 25.
- **Size** - The diameter or area of the culvert. Type: integer. Size: 2.
- **Length** - The length of the structure. Type: integer. Size: 3.

Bridges: In addition to the above attributes, bridge core data will also include the following:

- **NBI** - The code assigned to all bridges and dams under the National Bridge Inventory. Type: Integer. Size: 5

Fish passage and hydrography attributes: In addition to the location information above, these structures will include fisheries and hydrography information as determined by the agency

specialists. This section is a place holder for this information to be attached to the transportation framework information set. This information will then be linked to the hydrography framework as well.

Example:

Fish_Passage – A Y/N field describing whether fish can pass this barrier.
Fish_Species – The species related to fish passage. Code value based on scientific name.

Ongoing GIS Initiatives Since May of 1999

Over the past 3 years there have been involved in a series of ongoing GIS initiatives. These mainly fall under auspices of WAGIC and Transportation Framework Initiatives as well as a deep involvement in the IRICC (Inter-Organization Resource Information Coordinating Council) process. There has been a tremendous amount of good work done through these different efforts.

The following is an attempt to summarize these sometimes parallel efforts and to draw conclusions and comparisons between them. I'd like to start out by defining the different groups and providing links to their respective web sites when available.

GIS Organizations/Committees

1. WAGIC[1]: The Washington Geographic Information Council
    1. [1]http://www.wa.gov/gic/
    2. Transportation Framework Subcommittee
    3. The Ad hoc WAGIC Strategic Planning Committee
2. IRICC[2]: Inter-Organizational Resource Information Coordinating Committee
    1. http://www.iricc.org/index.html[2]

There are other initiatives that are concurrent with the above that I have only been tangentially involved. These include the FRAMEWORK Management Group, a sub-committee of WAGIC, as well as a newly established WAGIC Executive Committee on GIS organized under the ISB.

The WAGIC Transportation Framework Strategic Planning Committee[33]

This committee under the facilitation of George Spencer of the WSDOT Cartography and Mapping Lab, started in early June of 1999 and concluded its main objective in January of 2000. This objective was the Transportation Framework Charter.

We met monthly over that time period and usually provided a video conference uplink to other sites around the State of Washington. This was a fairly broad based and diverse group with members from Federal, State, Local as well as the Higher Education community.

During the months we met, the group worked out a document that became the Transportation Framework Project Charter. It was finalized in January of 2001 and then submitted to the FMG (Framework Management Group) and WAGIC for review and comments. This document became the working outline for the Transportation Framework initiative.

One of the main goals of the Plan was to move the Transportation Framework forward. In so doing a number of steps were outlined in the charter that would help define what the Key Deliverables and the Outcomes and Measure that should result. These were identified in the

[1] Washington State Geographic Information Council: http://www.wa.gov/gic/
[2] Inter-Organizational Resource Information Coordinating Committee: http://www.iricc.org/index.html
[3] Washington State Transportation Framework Project:
http://www.wsdot.wa.gov/gis/transframework/default.htm

original Charter as falling under two distinct categories: Project Deliverable and Management Deliverables.

Project Deliverables:

1. Business Needs
2. Business Requirements
3. Cost Benefit Analysis
4. Functional Requirements
5. Data Model
6. Database
7. Data Access and Distribution
8. Data Integration Standards
9. Partnership Agreements
10. Definition of Roles
11. Pilot Project to Populate the database
12. Plan for Maintaining the Transportation Framework
13. Project Reports

Management Deliverables:

1. Develop Decision Package and Funding
2. Establish Formal Project Reporting and Decision Making Structure
3. Project Charter
4. Risk Assessment and Management Plan
5. Communication Plan
6. Change Control Plan
7. Issue Management Plan and Dispute Resolution
8. Project Plans
9. Project Mini-charters

The outgrowth of these two sets of deliverables has resulted in both a number of direct and indirect initiatives to the Transportation Framework efforts. Perhaps most important to these initiatives was the official teaming with the Inter-Organizational Resource Information Coordinating Committee, or IRICC.

IRICC

The **Interorganizational Resource Information Coordinating Council** (IRICC) was established as a subcommittee to the Intergovernmental Advisory Committee (IAC). IRICC was charged with developing a seamless, current, and accessible information network to support ecosystem management in support of the Northwest Forest Plan, the Endangered Species Act, National Environmental Policy Act, Clean Water Act, Federally Reserved Rights, and other applicable direction pursuant to ecosystem management in Northern California, Oregon, and Washington.

Washington Framework efforts approached IRICC cautiously in the beginning, but, as it seemed there were parallel tracks being laid down, it made sense to engage in a dialog with this group. With the ongoing efforts being made by the FGDC as well as the National GeoData Center, it was sensible for Washington to look at what else was happening under the auspices of Transportation Framework initiatives.

As a result of the TFWK's efforts in putting together the Project Charter, it's inclusion in the IRICC process and our search for a model to follow, a decision was made to look closely at what

approaches were available for the Framework to follow. It was evident that there were many paths that could be pursued, one of which was the IRCC model. But, this was not the only approach. We needed to know more about what else was available. This effort was most headed by Ron Cihon and was an attempt to educate the Project Charter Team on what kinds of GIS approaches we could use to begin building "A Collaborative and Component Based Approach to Building Transportation Framework for Washington".

The outline of the process we wanted to follow was that beginning in early December of 2000, the Charter participants would begin a process of education as to what a transportation framework would look like. We developed a model that attempted to define the framework as being component based:

The Component Based Model

1. The framework is a comprehensive road network
2. Must have the ability to assign attributes to the road network
3. Must have the ability to associate other transportation objects or features to the road network and its attributes
4. There must be institutional arrangements that will make it all happens

The question was, of course, how does one go about creating such a tool? We had been exposed to the IRICC approach. What other approaches were there? A list of approaches were developed by Ron Cihon and it was determined that the Charter Participants should look at the various approaches and attempt to assess the approach or approaches that would fit our needs the best.

The Approaches to a GIS Transportation Framework Model

1. The Bundled Approach (IRICC)
2. The Modified Bundled Approach (Public/Private Partnership)
3. The Unbundled Approach (NSDI – FGCD)
4. The comprehensive data model approach (UNEtrans)
5. Internet/ Agent Approach

A Bundled Approach (IRICC) (http://www.iricc.org/)

As stated in the original charter, the vision of a Transportation Framework is to create a seamless set of data that is consistent, connected and continuous between segments of the transportation framework and other framework layers. It represents the best data available and includes mechanisms to improve it over time. And finally, the framework data should be accessible to the general public at the least cost with the least restrictions.

This approach is to re-construct a centerline map from a variety of participant's…local, state, federal, tribal and then assemble a core map with core data that provides the essential transportation framework components. This type of approach is sometimes referred to as a "Bundled Approach". Bundled, because the data is a collection of information garnered across agencies, and then conflated to fit at edges and jurisdictional boundaries and then held in a Central Clearinghouse where additional QC and QA are preformed and eventually, the data is made available through the Internet.

A Modified Bundled Approach (GDT) (http://www.geographic.com/home/index.cfm)

The charter group invited both ESRI and GDT (Geographic Data Technology) to present their vision of a Public Private partnership that would fulfill the needs of a transportation framework.

Mr. John Auble of GDT and Chris Wayne of ESRI gave the group a presentation of their teamed collaboration called Community Update. GDT is a private sector mapping company that provides ITS (Intelligent Transportation Systems) for various transportation interests around the country. This includes everything from rental car companies to transit and delivery companies. Under this vision, GDT is the steward of the data. The partners to the Community Update provide the information and GDT maintains the data in a central clearinghouse and it is distributed via the web to the participating partners.

The Unbundled Approach (NSDI)
(http://www.fgdc.gov/nsdi/nsdi.html)

Next on the list is the unbundled approach. This is the NSDI (National Spatial Data Infrastructure), which is the Federal Government's set of guidelines for the development of a National Road Network database. The premise here is that the Feds are not going to make a National Transportation Framework, but that it will come out the efforts of local and state agencies, which already have the best available data anyway.

The unbundled approach favors a decentralized distributed set of data guided by the principle set down in the NSDI standards. Without a guiding set of standards there can be no interoperability between datasets or geographic areas and no interoperability between different users even within the same geographic area. And the opportunity for massive data redundancy of course is extremely high.

The Comprehensive Data Model Approach (UNETrans – ESRI)
(http://arconline.esri.com/arconline/datamodels_one.cfm?id=14)

The UNETrans approach,
or the UNIFIED NETWORK-TRANSPORTATION DATA MODEL, provides a comprehensive transportation data model construct. This construct is part of an ongoing effort by ESRI to create a data model application that will focus on the needs of organizations that manage transportation networks. The intent is not to create a new set of standards but to provide a useable Transportation GIS Model that will:

- Simplify enterprise project implementations
- Encourage consistency in data structures to facilitate data sharing
- Provide a common starting point for application developers

Internet/Agent Approach (ESRI Network Geography)
(http://www.geographynetwork.com/data/tiger2000/)

Of all the approaches we looked at this one perhaps held the most intriguing promise…but was also the one in its utmost infancy. ESRI presented a vision of what an Internet centric "mined" geographic information system could look like using their Network Geography as the model. In this scenario, it is assumed that the information exists in cyberspace and simply needs a point of consolidation to come together.

- Contributors to the Network post links to their data sties
- Publishers put up data and map services
- Partners host map services and are commercially involved with the Geography Network
- All broadcasters post standard-format metadata.

Approaches Summation – What we learned

After looking at the different approaches, it became clear that each brought value to the table. But perhaps no single approach was structured to succeed on its own. Each had its merits…as well as its complications. To break it down, we looked at the strengths and weaknesses of each approach:

IRICC – GDT and the Bundled Approach[4]

The inherent strength of the IRICC approach is one that provides a centrally located clearing house where collected and submitted data can be vetted and quality control can be provided. A set of metadata standards can be applied up front that are used to establish the validity and accuracy of the data. This is also the value of the GDT approach where again, a centrally located clearinghouse is the waypoint for the collected data.

However, that being said, in both cases, the clearinghouse is also the weak point…or at least the intersection of the challenges to proceeding in this manner.

In the case of IRICC, a centralized clearinghouse means the necessity of having an organization in place that fulfills that role. A GIS steward housed either with some organization or agency that accepts that role. In the case of government, that would mean a new agency that would be the State GIS Clearinghouse. And therein lies the rub. Currently there is no agency that has been given that responsibility. If there was, it would provide local governments with cause for concern of having unfunded mandates to provide and support the building of framework elements.

In the case of GDT, a private company holds the keys to the clearinghouse. One of the basic tenets of the charter is to provide as wide of access as possible. Under a Private/Public partnership the challenge of access and licensing is always present.

In both cases there are also technical issues that need to be overcome to achieve a modicum of success. These include, but are not limited to transactional updating and update frequencies.

NSDI - The Unbundled Approach[5]

The strength of the NSDI approach is its realization that the best data is held at the local levels and that currency and accuracy can best be obtained there. The establishment of guidelines to provide a structure around which a framework can be constructed also is a strength. However, the institutional barriers and the complexity of a wide area distribution network both pose large hurdles to fulfilling the promise of a Transportation Framework. In addition, absent a centralized technical thread, or authority, gaps in coverage cannot be addressed.

[4] Geographic Data Technology: http://www.geographic.com/home/index.cfm
[5] National Spatial Data Infrastructure: http://www.fgdc.gov/nsdi/nsdi.html

UNETrans – The Comprehensive Data Model Approach[6]

This approach defines the model, but does not address how the data model is built. As a construct it casts a wide net and builds a model that attends to almost every transportation element. However, this will not get the Framework built.

Internet/Agent Approach

Unfortunately, this approach, for all its promise is not yet positioned to fulfill its potentiality. The web is not quite at the point where it can be an effective tool for the complex distribution of data from distributed sources. However, there are exciting possibilities that exist for serving end users with the data and this is the path that this approach should prove the most useful on.

IRICC

Having put to the test the approaches and educated ourselves as to the strengths and weaknesses each could bring to the table, the core charter members decided to engage more fully with the IRICC team. There were many reasons to pursue IRICC, not the least of which was the strong Federal presence that existed there as well as being able to build upon the work that IRICC had already accomplished.

As we engaged with this group, it became evident that there were many points of intersection that fit each group's goals. IRICC's charter states:

*The **Interorganizational Resource Information Coordinating Council** (IRICC) was established as a subcommittee to the Intergovernmental Advisory Committee (IAC). IRICC was charged with developing a seamless, current, and accessible information network to support ecosystem management in support of the Northwest Forest Plan, the Endangered Species Act, National Environmental Policy Act, Clean Water Act, Federally Reserved Rights, and other applicable direction pursuant to ecosystem management in Northern California, Oregon, and Washington.*

IRICC was also in the process of developing the framework layers, including transportation. This gave impetus to the Washington Framework Groups inclusion in their efforts.

The IRICC White Paper[7]

In mid 2001, with the funding assistance of the USGS and input from IRICC, the joint group comprised of Framework charter members and the IRICC working group, entered into an agreement with Kenneth J. Dueker of Portland State University to put together a White Paper whose purpose was to discuss the Issues and Strategies for Building a State Transportation Framework. This was accomplished through a grant from the USGS and was done for IRICC and the Washington State Transportation Department. Over the ensuing several months, Mr. Dueker provided the group, through an iterative approach, a working document that addresses the next steps to bring a Transportation Framework to fruition.

This white paper discusses the next steps to undertake to implement a Transportation Framework. The white paper builds on the work done with IRICC, The Washington Transportation Framework Charter, as well as the USGS, USFS, BLM, and the Washington and

[6] UNETrans: http://www.ncgia.ucsb.edu/vital/unetrans/

[7] Strategies for Building a Transportation Frameworkhttp://www.wsdot.wa.gov/gis/transframework/TFwpFINALApril.pdf, Dueker, et al, 2002

Oregon Transportation Departments. It provides a blueprint to follow and suggests a step by step approach to launching a Transportation Framework, including Pilot Project alternatives and business needs approaches.

The Dueker paper takes a "Bundled" approach methodology and looks at models that are in process in other states, drawing on those experiences and the needs of Washington to provide a "framework" from which to construct a Framework.

Other Ongoing Initiatives

The GEOData Alliance (http://www.geoall.net/)[8]

In 2002 Washington's WAGIC became a member of the GeoData Alliance. The Alliance is a coalition of organizations who are all striving toward creating an open and inclusive community to foster trusted and inclusive processes to enable the creation, effective and equitable flow, and beneficial use of geographic information. As a participating Institutional Member, WAGIC gains access to a wide network of other organizations that are on similar paths. This provides a network of information and experience that can be used to add substance and flavor to our own efforts.

2001 Strategic Planning Activity[9]
(http://www.wa.gov/gic/Plan01/2001_strategic_planning_activity.htm)

In concert with the ongoing Framework efforts, the Washington Geographic Information Council (WAGCI) initiated an update of the Strategic Plan for GIS in the State of Washington. In late March of 2001, a group of people representing a diverse selection of organizations met in Ellensburg to update the WAGIC strategic Plan for GIS in Washington. The result of this updated plan was a call for the completion of a Digital Framework for the state of Washington, including:

- Hydrography
- Transportation
- Cadastral
- Ortho-Imagery
- Topography
-

Current efforts are focused on Ortho-Imagery and securing long term funding for WAGIC.

Conclusions

These are but a few of the ongoing efforts being pursued at both the Framework and the larger GIS community level in the state of Washington. Many of these are parallel tracks and much time and effort has been expended in bringing these initiatives to bear. An ongoing theme that threads through all of the described initiatives is to continue to work on the Framework initiative and to complete a digital Framework for the State of Washington.

It is my view that the work already done have created a tremendous body of information that needs further analysis and compilation to create a seamless overview of the strategies and efforts that have been completed. I believe there is a significant amount of work that has been done that

[8] GeoData Alliance: http://www.geoall.net
[9] 2001 Strategic Planning Activities: http://www.wa.gov/gic/Plan01/2001_strategic_planning_activity.htm

has yet to be fully appreciated and or acted upon. The re-invention of this work is a Sisyphean task that serves little purpose. I believe that an effort to consolidate the work that has been accomplished is the best way to move forward in an expeditious manner at this time.
Too much good works exists for it to be set summarily aside in favor of another flavor of the month. This is not to say that there are not methods or ideas out there that are not worth looking at…in fact when a viable model presents itself, certainly it should be carefully reviewed as to it applicability to our efforts here. However, that being said, I believe the Dueker paper lays out a legitimate course of action to begin the implementation of a Washington Transportation Framework.

Dueker's paper provides an overview of:

1. Who's doing what, where, in the Transportation Framework arena,
2. An assessment of Business Needs
    a. Emergency Management
    b. Salmon Enhancement
    c. Infrastructure Management

The Dueker paper provides a roadmap on how to get from where we are to where we want to be. In my view, to not use this work would be a step backwards and erect additional barriers to completing the framework. It is time we put aside analysis and make a leap into being proactive.

Additional Resources

Federal Geographic Data Committee	**http://fgdc.er.usgs.gov/**
National States Geographic Information Council	**http://www.nsgic.org/indexframe.html**
Oregon Spatial Data Clearinghouse	**http://www.sscgis.state.or.us/index.html**
Thurston County GeoData Center	**http://www.geodata.org/**
USGS National Mapping Information	**http://mapping.usgs.gov/**